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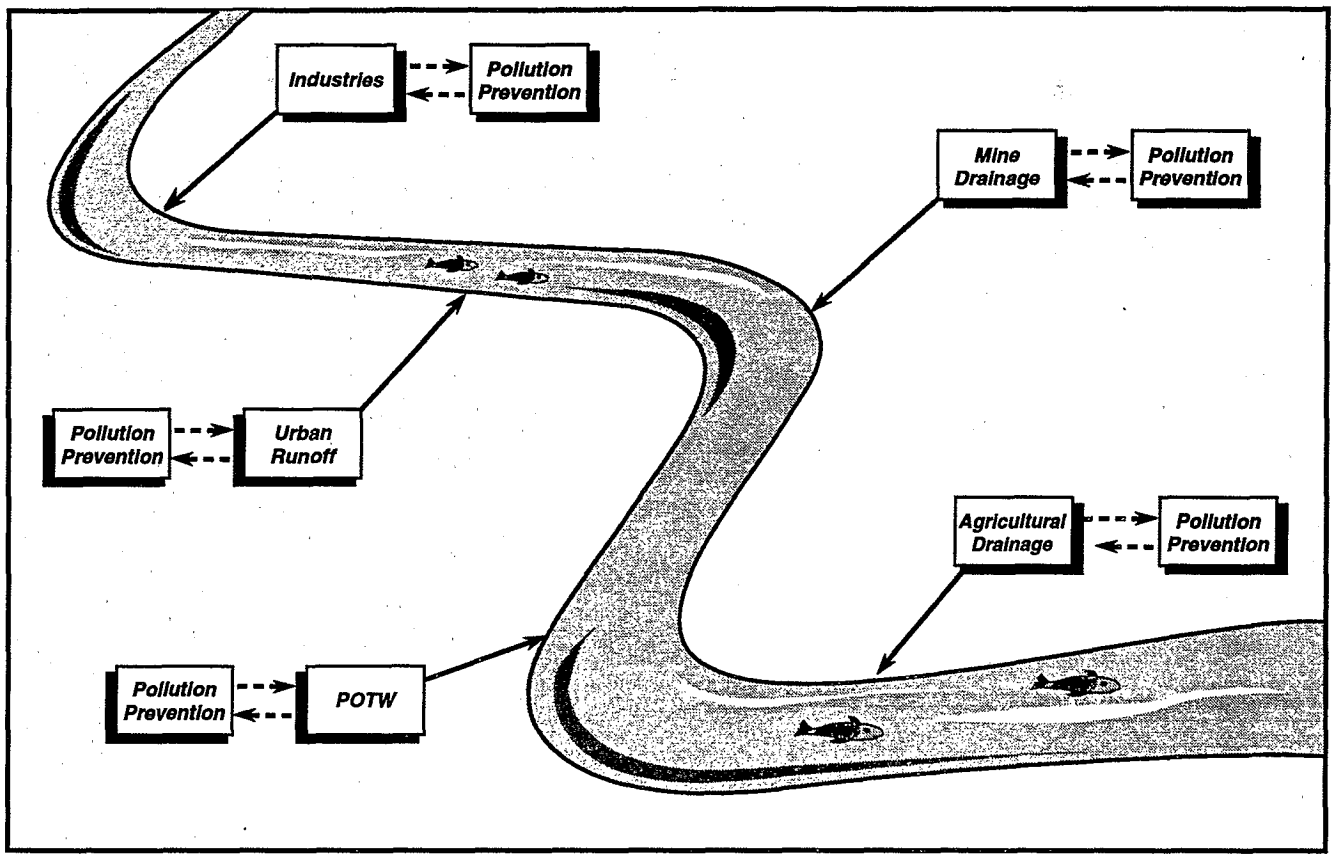
Tri-TAC Water Committee

Technical Issue Paper



The Role of Pollution Prevention in Toxicity Control

May 1994

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THE ROLE OF POLLUTION PREVENTION IN TOXICITY CONTROL

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Tri-TAC Water Committee

Executive Summary

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EXECUTIVE SUMMARY

The League of California Cities, California Association of Sanitation Agencies, and the California Water Pollution Control Association jointly sponsor a technical advisory committee on water, air, and solids issues in California, namely Tri-TAC. In this paper, the Tri-TAC Water Committee analyzes the role of pollution prevention in water quality regulations and toxics control, and recommends an approach for incorporating pollution prevention into a watershed management-based framework for reducing toxics loadings to our nation's waterways while ensuring the most cost-effective use of public funds.

In order to successfully implement a coordinated water quality control program across diverse watersheds with many different activities, a clear direction and role for pollution prevention must be defined. To this end, the purpose of this paper can be summarized as follows:

- Explore the federal definitions of pollution prevention and highlight the different definitions being applied at California POTWs in implementing their pollution prevention programs
- Define the role of pollution prevention within the watershed management approach to toxicity control
- Establish the elements of a targeted pollution prevention program that focus resources where they will be most useful in attaining water quality standards
- Identify the specific areas where state and/or EPA assistance is needed to effectively implement coordinated, consistent pollution prevention programs

WHAT IS POLLUTION PREVENTION?

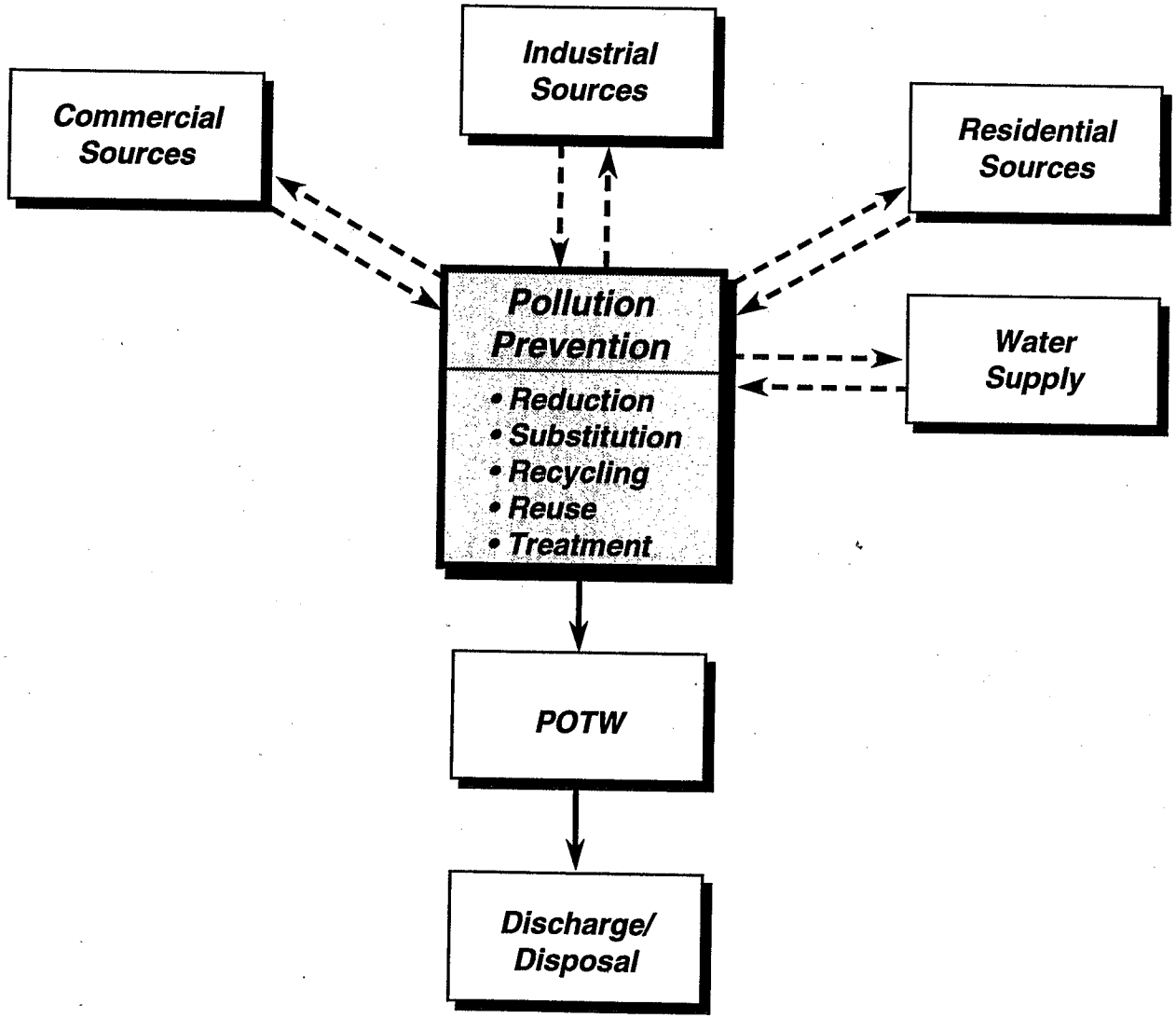
Pollution prevention has come to mean many different things to different people. Definitions contained in the Pollution Prevention Act of 1990, and policy statements issued by EPA indicate a clear national policy to prevent pollution at the source whenever feasible, and only to resort to disposal when other means such as recycling and/or treatment prove unfeasible.

Tri-TAC and its member agencies fully support and are actively implementing the vision conveyed by Congress and EPA of looking upstream at pollution sources to prevent further degradation of our waterways. However, pollution prevention policies and regulations have been too narrowly focused on industrial point sources without sufficient consideration to other, less visible sources of toxic pollutants such as commercial and residential point sources as well as nonpoint sources such as urban runoff, agricultural drainage and abandoned mine drainage. While pollution prevention will continue to be vital at industrial point sources, the implementation and guidance of pollution prevention must not be limited to this narrow population of point sources.

Publicly owned treatment works (POTWs) have adopted a broad-based view when applying the "upstream" approach of pollution prevention in an attempt to meet increasingly stringent discharge requirements. While the federal regulatory language depicts pollution prevention as a measure to be applied prior to recycling or treatment of a waste stream, POTWs view these measures as potential pollution prevention measures to be applied prior to sewer discharge. From the perspective of POTWs, pollution prevention should be defined as *any measure*, whether technical, institutional, or educational, that contributes to reduced mass loadings of pollutants to the sewer system. Figure E-1 presents the approach to pollution prevention taken by many California POTWs to reduce influent pollutant loadings.

Despite many successes of individual programs being implemented at POTWs, the impacts on overall water quality in the associated receiving waters tend to be negligible where comparable measures are not being implemented at nonpoint sources. In California, the pollutant contributions from nonpoint sources are believed to be many times more significant than municipal and industrial point sources, yet few control measures are being implemented where they are most needed. As seen in Figure E-2, POTWs are typically just one of many types of sources discharging pollutants to a given water body. States and EPA must recognize in their pollution prevention policies that even though point sources are typically the easiest to target for pollutant reductions, the cost-effectiveness of these measures is severely diminished where point sources contribute only a minor portion of the mass loadings to a water body.

The conventional scope of pollution prevention policies must also be expanded beyond the intangible educational measures to include structural improvements as well. Certain structural measures are applicable to point and nonpoint sources and certainly within the spirit of pollution prevention.



POTW APPROACH TO POLLUTION PREVENTION

FIGURE E1

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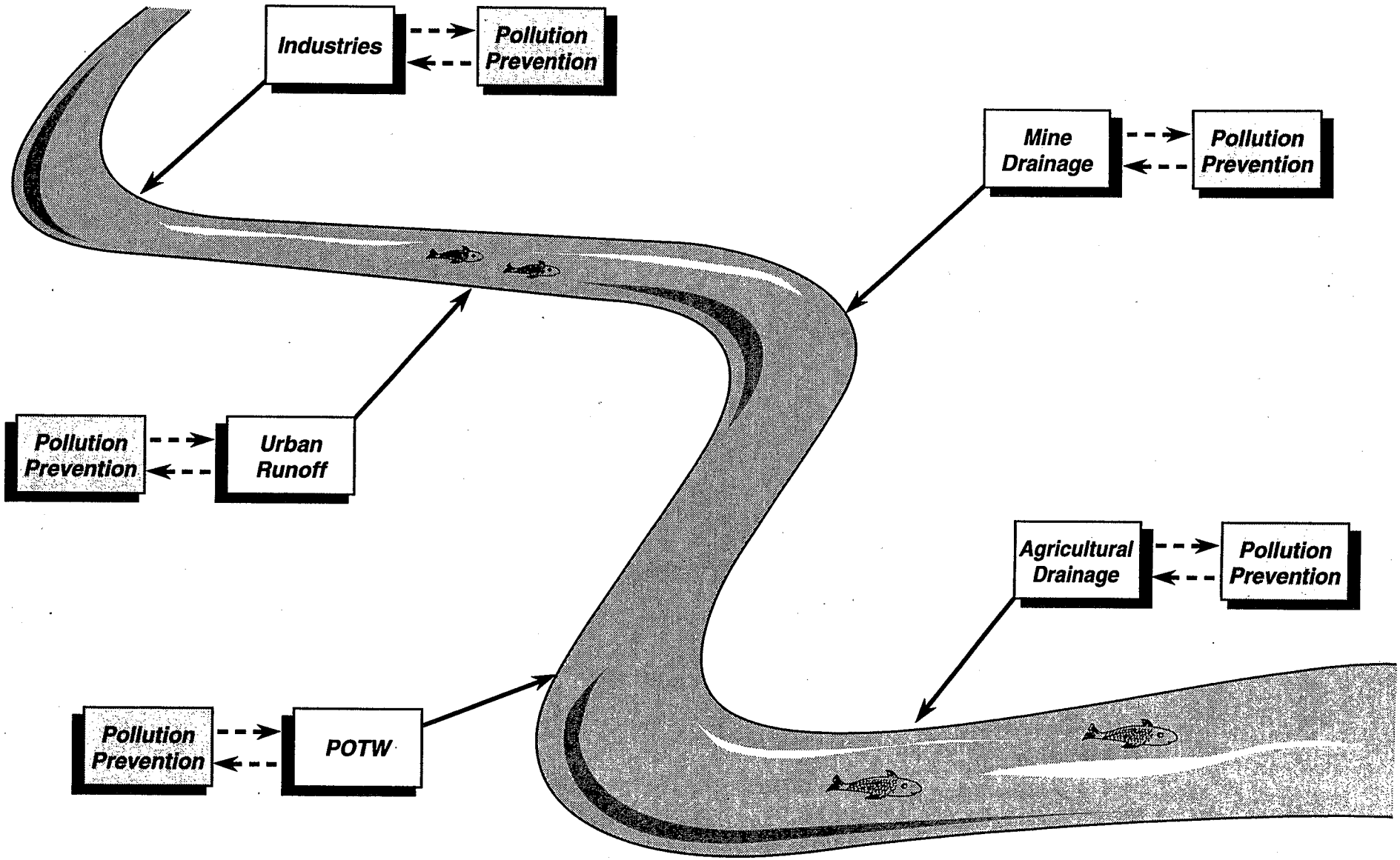

HOLISTIC APPROACH TO POLLUTION PREVENTION

FIGURE E2

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RECOMMENDED APPROACH TO POLLUTION PREVENTION

Tri-TAC's recommended approach to pollution prevention relies on incorporating pollution prevention measures into an overall watershed management approach to toxics control. The following points summarize the recommended approach for water bodies not currently attaining the water quality standards (WQSs) developed in accordance with the current Clean Water Act. Figure E-3 illustrates how the proposed approach fits into a modified version of EPA's Total Maximum Daily Loading (TMDL) approach to toxics control.

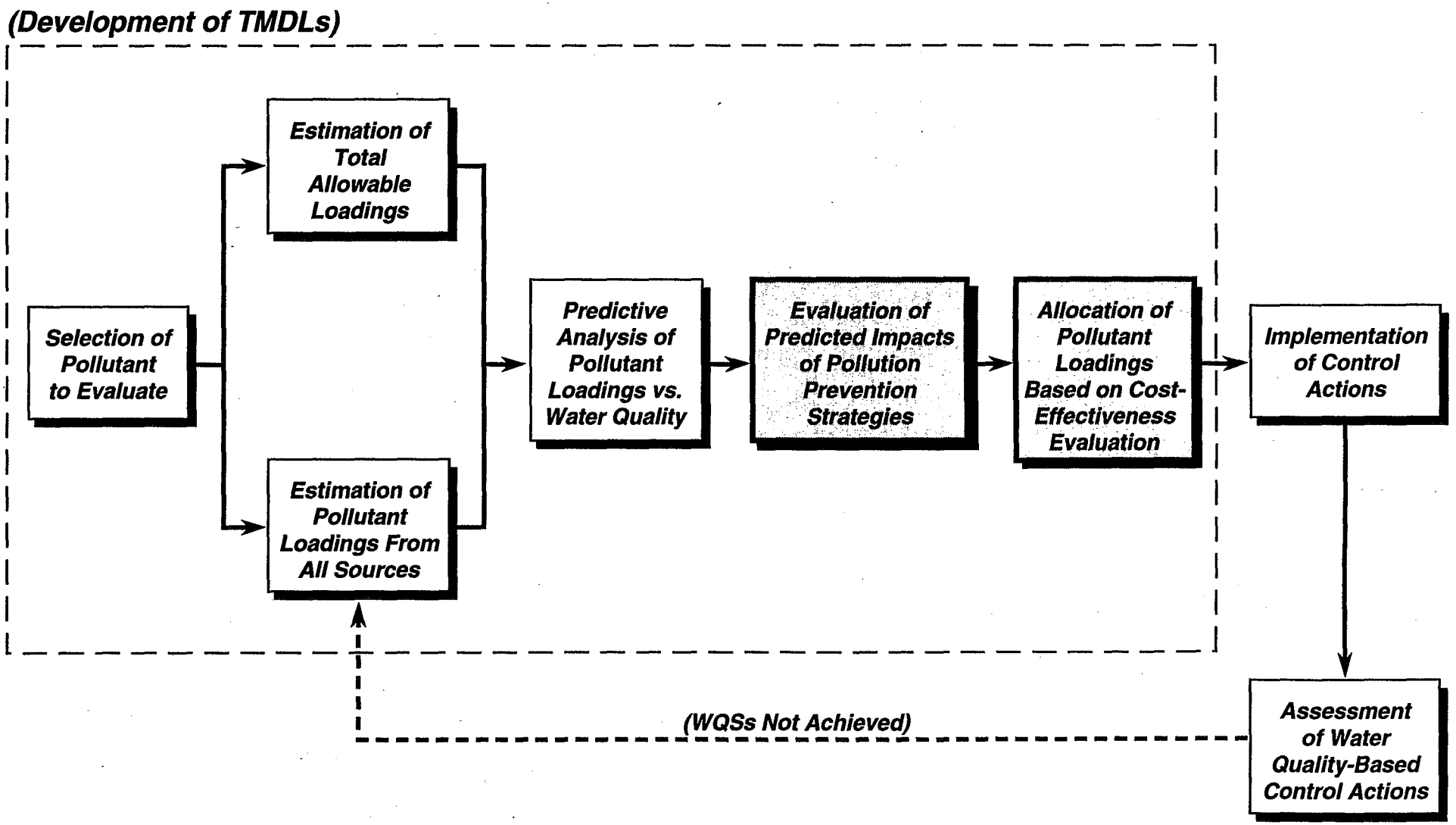
- Using the watershed management approach, the major contributors of specific toxic pollutants to a given water body are identified, regardless of whether or not they are point or nonpoint sources. These contributors may vary for different pollutants.

- The alternative pollution prevention measures and expected feasible pollutant reductions are identified for each of the pollutant contributors.

- A cost-effectiveness evaluation is conducted to allow a ranking of the alternative pollution prevention measures at each source according to the expected dollars spent per pound of pollutant removed. The cost-effectiveness of the most cost-effective pollution prevention measures is compared to that of end-of-pipe treatment measures at each source.

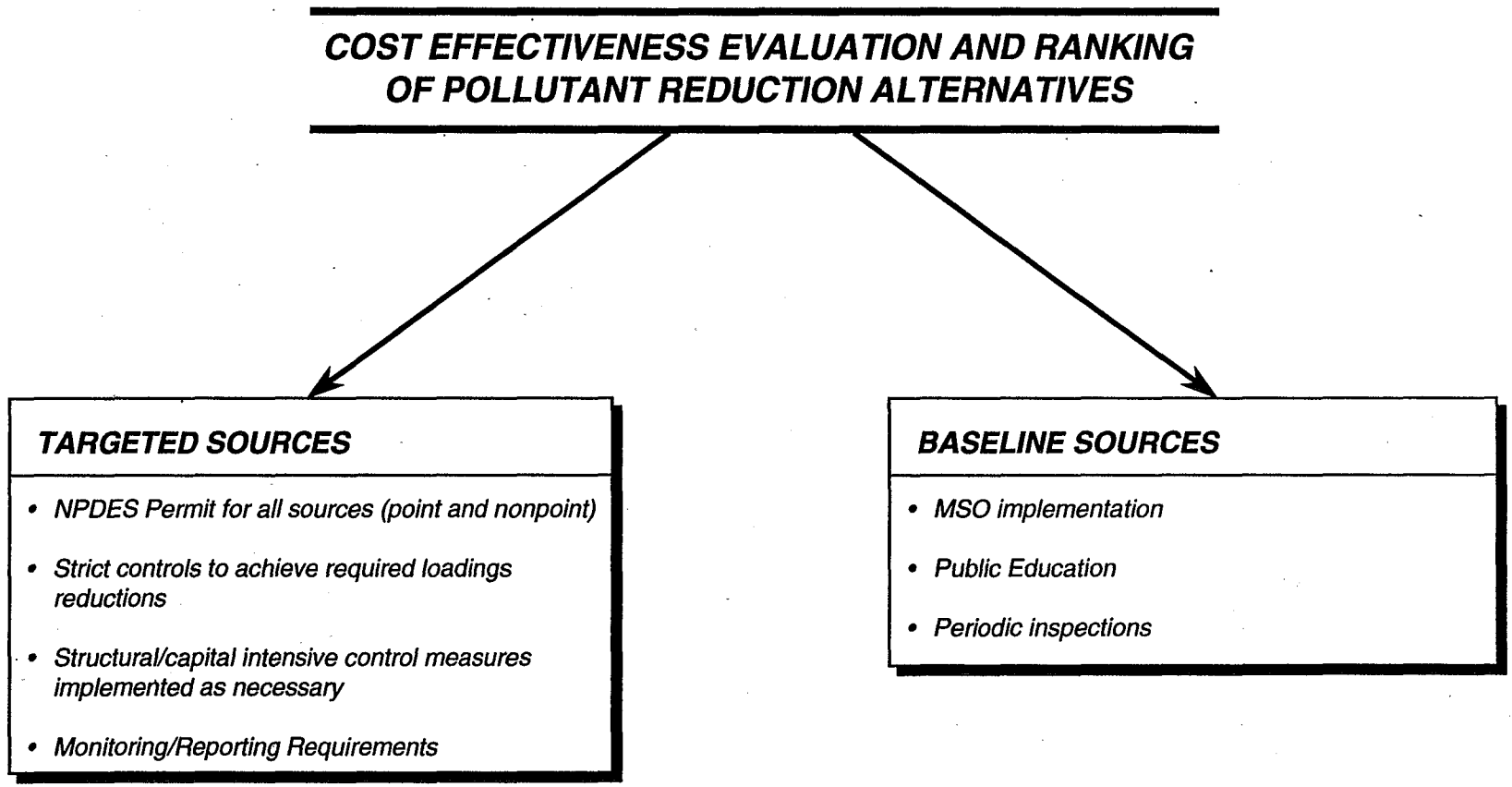
- Alternative pollutant reduction measures are selected among the different sources (in decreasing order of cost-effectiveness) depending on the total mass reductions required to achieve the WQSs for the associated water body. The most cost-effective pollutant reduction measures could include both pollution prevention measures at certain sources and end-of-pipe treatment at others.

- The most cost-effective "targeted" sources are assigned specific numerical loadings reduction goals that must be complied with. The remaining sources must employ a baseline program that includes minimum standards of operation (MSOs). Figure E-4 differentiates between measures to be implemented at targeted and baseline sources following a cost-effectiveness evaluation.



THE ROLE OF POLLUTION PREVENTION IN WATERSHED MANAGEMENT APPROACH

FIGURE E3



A TARGETED APPROACH TO COMPLIANCE WITH WATER QUALITY STANDARDS

FIGURE E4

For water bodies that are currently in attainment with WQSs, all associated pollutant sources would be required to employ MSOs, but none would be targeted to achieve specific loadings reductions.

RECOMMENDED ACTIONS

Tri-TAC is recommending that the following actions are taken by EPA and the State Board to promote full implementation of pollution prevention within the framework of watershed management as discussed in Section 3 of this issue paper:

- Adopt a statewide policy and approach towards pollution prevention.
- Develop a pollution prevention clearinghouse to disseminate educational materials and effectiveness data as they are developed.
- Shift towards mass pollutant limitations as the regulatory mechanism and promote pollution prevention as the means of compliance.
- Recognize that pollution prevention is an effective means of mass reduction.
- Recognize that there is uncertainty in applying pollution prevention to comply with maximum numerical concentration limits.
- Require strict compliance with effluent water quality criteria only at sources that have been targeted for pollutant reductions as part of the watershed management approach.
- Modify the current regulations in order to create incentives to implement reclamation for pollution prevention.
- Resolve conflicts between existing regulatory measures in order to promote implementation of pollution prevention.
- Develop pollution prevention goals with a coordinated approach towards the individual goals of municipal and hazardous solid waste, air, and water agencies; and provide additional guidance or assistance in this area to reduce the additional regulatory and staffing burden that this places on pollution prevention personnel.

- Take the lead in defining MSOs for different sources (e.g., POTWs, agricultural sources, stormwater sources), developing guidance where necessary, and disseminating available state and federal literature on best management practices to be employed at residences, commercial, and industrial facilities.

- Assume the lead role in characterizing waste streams from the commercial and residential sectors. In addition to identifying these waste streams, feasible pollution prevention measures should be evaluated and established for any controllable product, sources, or waste streams of potential concern.

- Assume the lead role in identifying consumer and commercial products that contain notable amounts of toxic pollutants and in encouraging substitute materials.

- Develop guidance and leadership in restricting the uses of products on a regional or state-wide level.

The Role of Pollution Prevention in Toxicity Control

Tri-TAC Water Committee

Section 1

Introduction

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SECTION 1

INTRODUCTION

Nearly everyone agrees that pollution prevention is an excellent idea. It is becoming a central component of most federal, state, and regional water quality policies, and at times is even touted as an all-encompassing solution to the problems of water quality degradation that this country has witnessed in the last century. Yet, to many legislators, dischargers, and regulating agencies, pollution prevention still has a variety of different meanings and expectations.

Pollution prevention occurs in many forms and has historically meant many different things to different people. While the federal focus on pollution prevention has been oriented towards industrial point sources, publicly owned treatment works (POTWs) in California have been implementing their own "pollution prevention," "source control," "waste minimization," or similar such programs aimed at reducing loadings from all of the diverse pollutant sources discharging to their systems. Various definitions exist for these programs, but in reality, different program coordinators likely have their own definition of pollution prevention, and their own idea as to how this nice catch-all phrase fits into their environmental protection or compliance goals. While the flexibility and individual-tailoring of pollution prevention programs must continue, a clear framework is needed to enhance the effectiveness and efficiencies of these programs.

The League of California Cities, California Association of Sanitation Agencies, and the California Water Pollution Control Association jointly sponsor a technical advisory committee on water, air, and solids issues in California, namely Tri-TAC. In this paper, the Tri-TAC Water Committee analyzes the role of pollution prevention in water quality regulations and toxics control, and recommends an approach for incorporating pollution prevention into a watershed management-based framework for reducing toxics loadings to our nation's waterways while ensuring the most cost-effective use of public funds.

THE NEED FOR POLLUTION PREVENTION

The pollution prevention agenda was far simpler in the past when water quality degradation was primarily the result of point source discharges, and improvements to our waterways could most quickly and cost-effectively be implemented by upgrading treatment systems at industrial dischargers and POTWs. With significant advancements in treatment technology and

widespread implementation of pretreatment programs, the balance of pollution sources in California has changed; these traditional industries are generally contributing a smaller percentage of the pollutants entering our state's waterways. While there continues to be a need for effective pollution prevention at industries, we must now also focus on the more diffuse, broad-based pollutant sources such as agricultural and urban runoff, commercial businesses, and household toxics. These sources are not as easily identifiable or controllable as the industrial or POTW discharge pipe, but focusing on the visible point sources alone is no longer the most cost-effective approach. Pollution prevention is the favored approach to address these sources for which control is becoming increasingly vital. Its precise role in protecting and enhancing water quality must now be defined.

A coherent strategy is needed for how pollution prevention should be incorporated into the goals of meeting water quality objectives for preserving and protecting the health of human, aquatic, and wildlife species. Realistic and cost-effective guidelines are needed to define who needs to do pollution prevention and how far should pollution prevention be taken at each pollutant source. Pollution prevention must be established in a regulatory framework as a potential cost-effective alternative to end-of-pipe treatment, rather than merely an interim measure prior to implementing end-of-pipe treatment measures.

WATERSHED MANAGEMENT APPROACH

Our 1992 issue paper, entitled: "Watershed Management Approach to Toxicity Control," explained that the most efficient means of achieving water quality standards is by implementing a comprehensive watershed management approach to identifying and controlling the sources of toxic pollutants. The watershed management approach is rooted in our belief that further investment in point source controls will produce diminishing returns in water quality enhancement due to the far greater contribution of toxics entering our nation's waterways from non-point sources. In addition to recommending a prioritization process for targeting point and non-point sources for water quality control actions, the 1992 issue paper called for the implementation of minimum standards of operation (MSOs) for all significant point and non-point sources. As discussed in Section 3 of this paper, the watershed management approach, including these MSOs, will provide the framework for our recommended approach to pollution prevention.

ROLE OF POLLUTION PREVENTION

In order to successfully implement a coordinated water quality control program across diverse watersheds with many different activities, a clear direction and role of pollution prevention must be defined. To this end, the purpose of this paper can be summarized as follows:

- Explore the federal definitions of pollution prevention and highlight the different definitions being applied at California POTWs in implementing their pollution prevention programs

- Define the role of pollution prevention within the watershed management approach to toxicity control

- Establish the elements of a targeted pollution prevention program that focus resources where they will be most useful in attaining water quality standards

- Identify the specific areas where state and/or EPA assistance is needed to effectively implement coordinated, consistent pollution prevention programs

Section 2 of this paper examines the definition of pollution prevention, and illustrates how the federal perspective generally differs from what is actually practiced at California POTWs. Section 3 presents our recommended approach to pollution prevention, including how it should be incorporated into the watershed management approach to toxics control. Finally, Section 4 outlines recommended actions to be taken by EPA and the State of California to recognize and facilitate the important role of pollution prevention in achieving our nation's high standards for water quality.

Tri-TAC Water Committee

Section 2

What Is Pollution Prevention?

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SECTION 2

WHAT IS POLLUTION PREVENTION?

Pollution prevention has come to mean many different things to different people. This section contrasts the federal definitions and policy statements regarding pollution prevention with the actual programs currently being implemented at POTWs under the same name.

NATIONAL POLLUTION PREVENTION POLICY

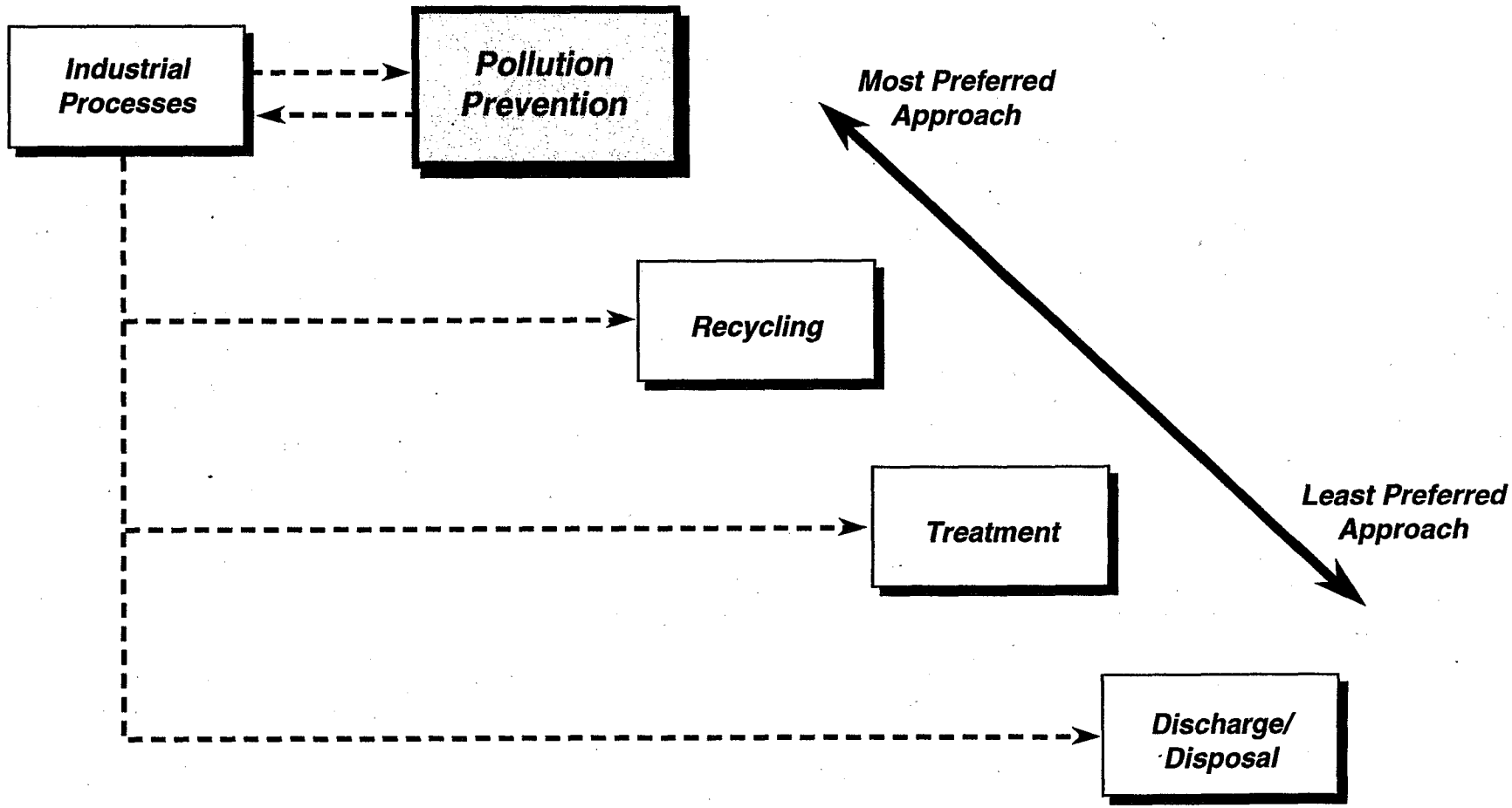
In the Pollution Prevention Act of 1990 (PPA), Congress declared it to be the national policy of the United States that:

> "pollution should be prevented at the source whenever feasible; pollution that cannot be prevented should be recycled in an environmentally safe manner, whenever feasible; pollution that cannot be prevented or recycled should be treated in an environmentally safe manner whenever feasible; and disposal or other release into the environment should be employed only as a last resort and should be conducted in an environmentally safe manner." {§ 6602(b)}

The term "source reduction" is then defined, in part, as:

> "any practice which reduces the amount of a hazardous substance, pollutant, or contaminant entering the waste stream or otherwise released into the environment (including fugitive emissions) prior to recycling, treatment, or disposal...." {§ 6603 (5)(A)}

Figure 1 depicts a schematic view of the U.S. national policy on pollution prevention. In EPA's "Pollution Prevention Policy Statement," issued in June 1993, EPA Administrator Carol Browner supported the definition laid forth in the PPA, and acknowledged that EPA has learned over time that "traditional 'end-of-pipe' approaches not only can be expensive and less than fully effective, but sometimes transfer pollution from one medium to another. Additional improvements to environmental quality will require us to move 'upstream' to prevent pollution from occurring in the first place." The Policy Statement then goes on to discuss implementing pollution prevention "through developing environmental standards through a series of permits, inspections, and



U.S. NATIONAL POLICY ON POLLUTION PREVENTION

FIGURE 1

enforcement actions." Browner states that she "firmly believe(s) that strong environmental requirements, if designed to encourage cost-effective compliance strategies from industry, can promote pollution prevention and improve the competitiveness of American industry." (EPA, 1993)

Tri-TAC and its member agencies fully support and are actively implementing the vision of looking "upstream" conveyed by Congress and EPA through these policy statements. In California, extensive historical efforts on proper treatment and disposal of industrial and hazardous wastes have resulted in significant reductions in toxic pollutant discharges to POTWs and downstream water bodies. Pollution prevention is the most cost-effective, widely applicable, and environmentally sound means of reducing the remaining pollutant loadings from upstream sources. It is a "win-win" policy that typically allows cost-savings and environmental benefits for both the discharging and regulating parties involved. However, it is clear from these federal policy statements that the national policy towards pollution prevention has been too focused on industrial point sources without sufficient consideration to other, less visible sources of toxic pollutants.

It is obvious that implementation of pollution prevention will continue to be vital at industrial point sources. However, pollution prevention is so important that its implementation and guidance must not be limited to the narrow population of industrial point sources. At one time, it was safe to say that industrial dischargers were the largest contributors of pollutants to our nation's waterways. In California, this is often not the case anymore, as nonpoint sources such as abandoned mine drainage, agricultural drainage, and urban runoff can contribute more pollution in many areas than all of the local point sources combined. A Public Trust Report, "California's Rivers," cited nonpoint sources as being "many times more significant than point sources such as municipal and industrial sources." (CSLC, 1993)

It is no longer even the case that industries contribute the majority of toxic pollutants to all municipal sewer systems. A 1991 U.S. General Accounting Office (GAO) report on water pollution cited a growing trend in which commercial and residential sources will contribute an increasing percentage of the pollutants discharged to POTWs relative to industrial sources. According to the GAO report, EPA estimated that these sources will "ultimately account for almost two-thirds of the toxic metals discharged to treatment plants." (GAO, 1991) Estimations of the relative contributions of sources discharging copper loadings to POTWs in northern California indicate that this progression has already occurred in many California cities. Three recent studies depict industries as contributing less than 25 percent of the total influent copper

loadings; the results of one such sources identification evaluation are shown in Figure 2. Appendix A contains additional examples of source loadings data gathered from California POTWs.

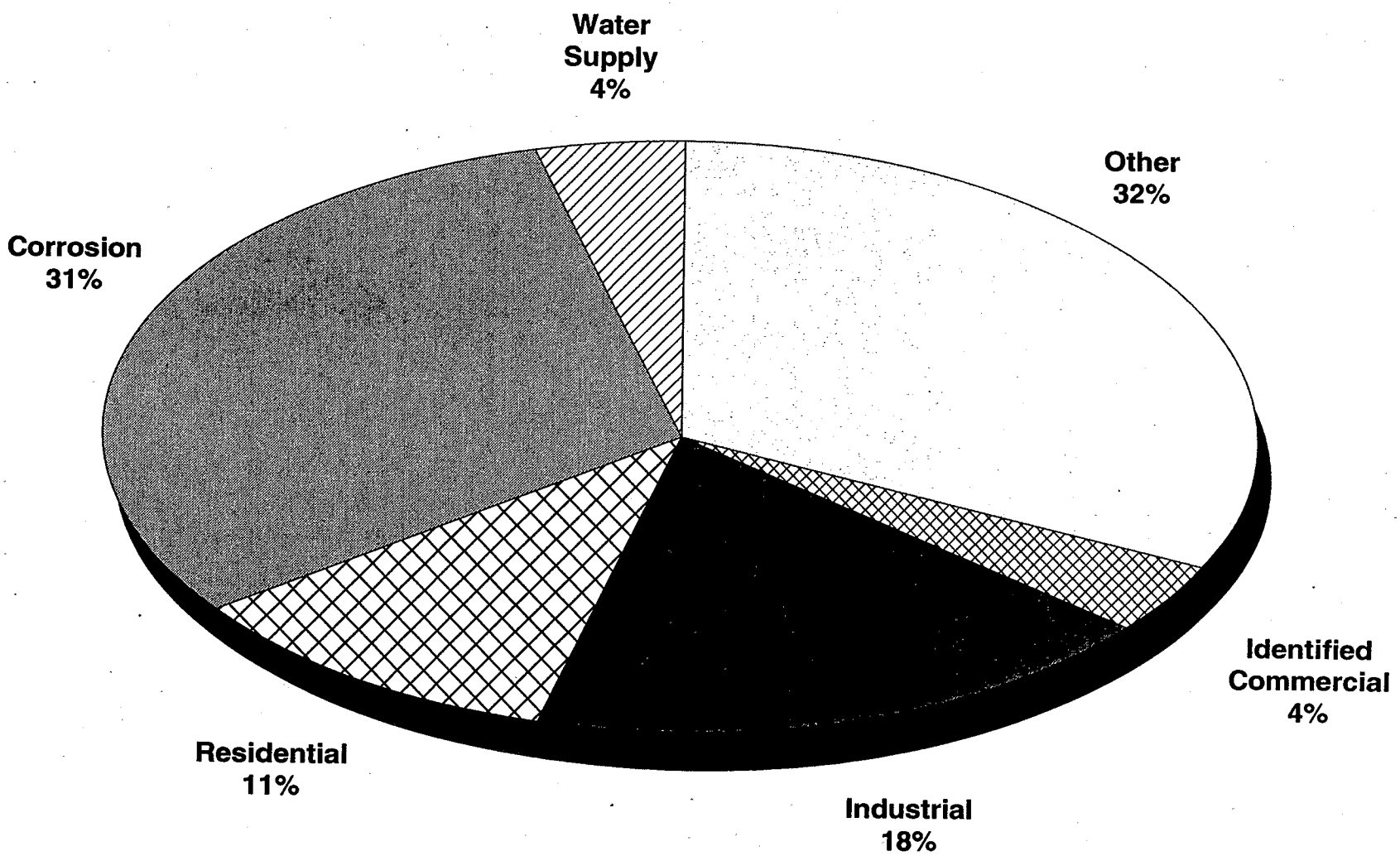
Proposed revisions to the Clean Water Act (very much in a state of flux at the time of this writing) hold promise for improvement of the national policies by considering the entire watershed in water quality planning, and focusing substantial attention to controlling nonpoint sources of pollutants. Tri-TAC agrees that this attention is needed. However, the proposed legislation appears to offer little in the way of recommending guidance for POTWs to implement pollution prevention among the various sources, or prioritizing pollutant sources within a watershed for cost-effective water quality controls.

POTW APPROACH TO POLLUTION PREVENTION

Publicly owned treatment works (POTWs) have adopted the "upstream" approach of pollution prevention as an attempt to meet increasingly stringent discharge requirements. However, "pollution prevention" as applied to POTWs typically represents a much broader view then that depicted in the EPA Policy Statement.

EPA's policy towards pollution prevention are sufficient for the purposes of establishing national priorities to reduce and recycle waste to the extent possible before resorting to treating or disposing it. Tri-TAC supports these priorities. However, they do not consider the unique perspective of POTWs as implementors of pollution prevention policies to reduce influent pollutant loadings. From the perspective of POTWs, pollution prevention should be defined as *any measure*, whether technical, institutional, or educational, that contributes to reduced mass loadings of pollutants to the sewer system.

For POTWs themselves, and other sources where direct discharge is occurring to a water body, then the scope of pollution prevention measures would exclude end-of-pipe treatment. For example, pretreatment steps occurring at industries or commercial businesses discharging to the sewer system, even if in the form of enhanced end-of-pipe treatment, are considered pollution prevention measures. In contrast, enhanced end-of-pipe treatment at the POTW is not considered a pollution prevention measure, but rather the antithesis of pollution prevention. Therefore, when a POTW implements a pollution prevention program for dischargers to its system, it may consist of recommendations of pollution prevention measures such as product substitution, waste reduction, recycling and reuse, as well as more capital-intensive measures such as enhanced end-



DISTRIBUTION OF SOURCES OF COPPER LOADINGS TO ONE SAN FRANCISCO BAY POTW

FIGURE 2

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of-pipe treatment. Pollution prevention is generally implemented by the POTW as a cost-effective measure to minimize the end-of-pipe treatment necessary at the POTW to meet water quality objectives.

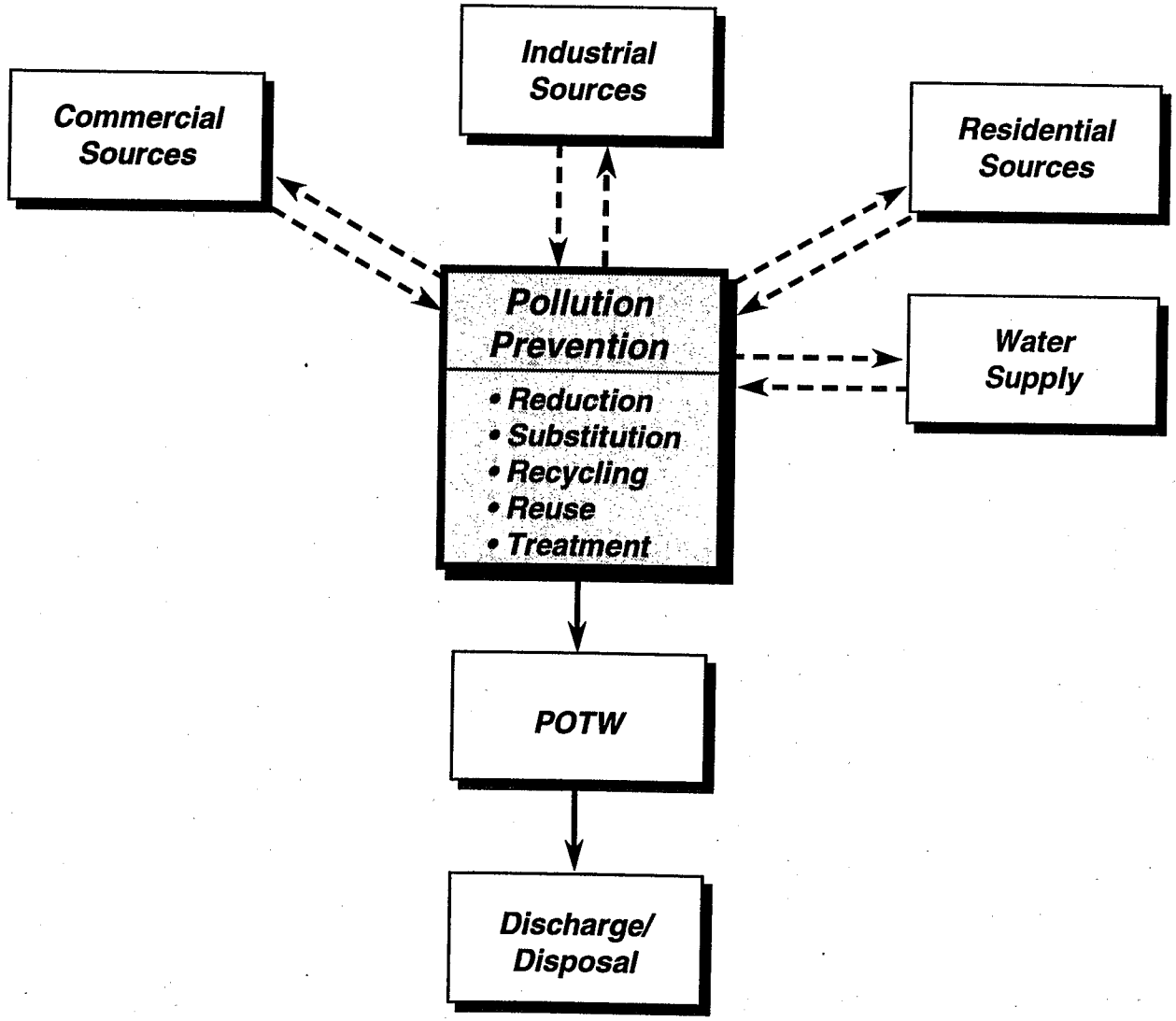
While a POTW's pollution prevention program should start by permitting and controlling any industrial dischargers, in accordance with the diverse sources contributing to these facilities, an effective program must also include source reduction, public education, and outreach measures aimed at commercial businesses, residential households, and water supply agencies. Figure 3 illustrates the approach that many California POTWs are taking to pollution prevention.

Response to State Policies

The State of California's Water Resources Control Board (State Board) has endorsed pollution prevention as a priority measure above end-of-pipe treatment steps in its state water quality plans (SWRCB, 91a and 91b). Adopted in 1991, the State Board plan called for POTWs to attempt to meet water quality objectives through pollution prevention until 1996. If, at that time, it is determined that these measures were not going to be adequate to achieve compliance, then end-of-pipe measures would need to be evaluated and installed to ensure compliance by the year 2001.

In accordance with the priorities of the State Board, many POTWs have implemented or investigated pollution prevention programs as a means to meet stringent effluent standards. Some of these programs have resulted in substantial reductions in influent pollutant mass loadings to POTWs, showing that pollution prevention measures can represent both a less costly and more environmentally sound approach to reducing discharge concentrations at the POTW compared to installing advanced treatment measures such as reverse osmosis. This potential for cost-effective reductions at upstream locations in the collection system is intuitive in that it is typically far easier and less costly to remove pollutants when they are contained in concentrated, low-flow wastestreams than when they are diluted within the larger flows often received at the POTW.

Despite many successes of individual programs being implemented at POTWs, the impacts on overall water quality in the associated receiving waters tend to be negligible where comparable measures are not being implemented at nonpoint sources. This is particularly true in the San Francisco Bay - Sacramento River Watershed Delta system, where nonpoint sources have been



POTW APPROACH TO POLLUTION PREVENTION

FIGURE 3

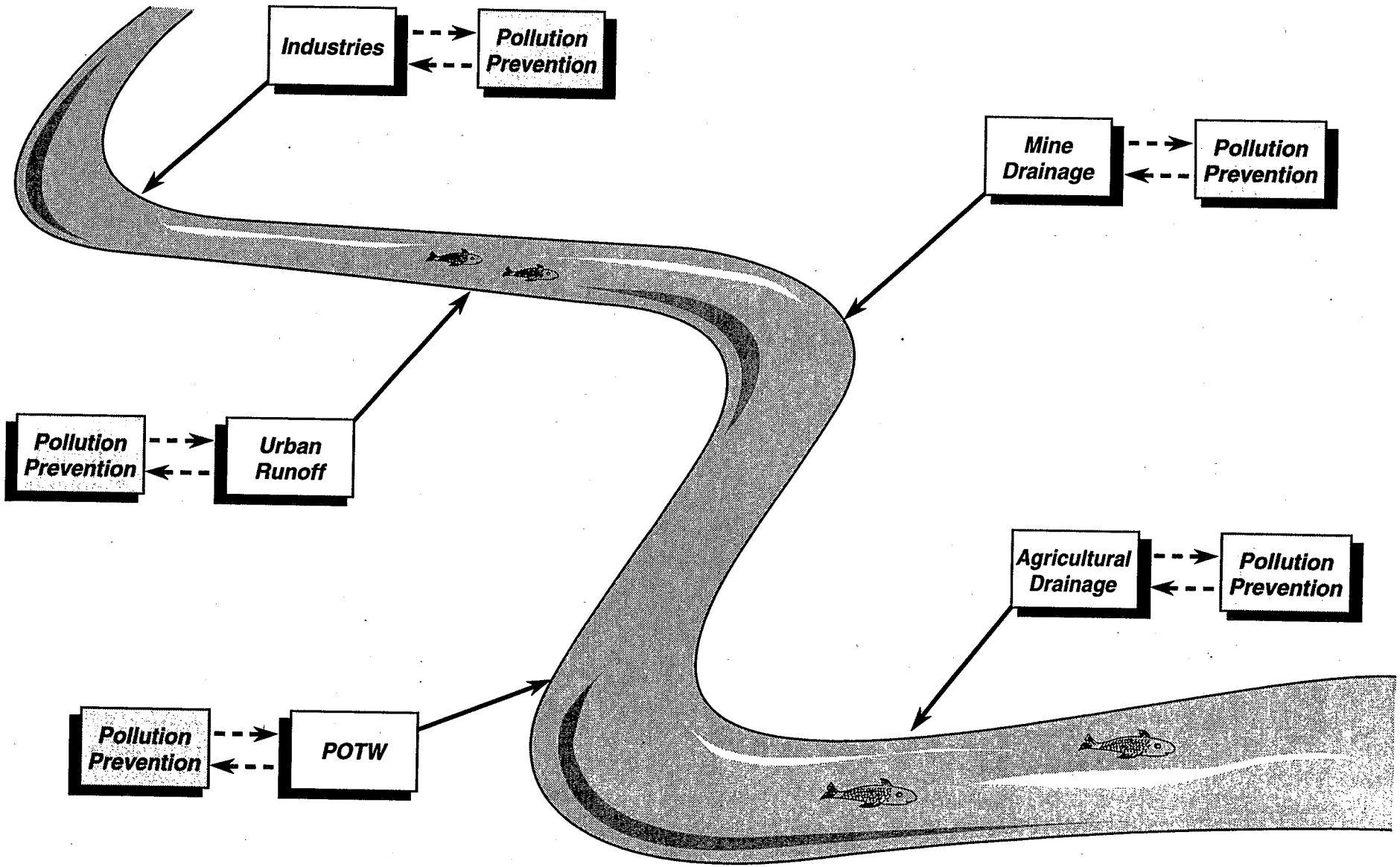
estimated as contributing over 94 percent of metals, as compared to the less than 6 percent attributed to point sources (SWRCB, 1989).

EXPANDING THE SCOPE OF POLLUTION PREVENTION POLICY

As shown in Figure 4, POTWs are typically just one of many types of sources discharging pollutants to a given water body. The policy of the State Board of implementing pollution prevention as an experimental interim measure prior to end-of-pipe treatment, while appearing progressive on the surface, is flawed due to its narrow focus. This policy does not consider the broader picture which shows that end-of-pipe treatment at POTWs would, in many locations, have little impact on the achievement of water quality objectives. Pollution prevention measures should be applied at each of the sources contributing to a water body, with more rigorous measures targeted towards the more significant contributors. It is clear that the historical point-source-based approaches to pollution prevention will not attain water quality standards for degraded water bodies without comparable measures aimed at nonpoint sources. States and EPA must recognize in their pollution prevention policies that even though point sources are typically the easiest to target for pollutant reductions, the cost-effectiveness of these measures is severely diminished where point sources contribute only a minor portion of the mass loadings to a water body.

The scope of pollution prevention policies must also be expanded beyond the intangible educational measures to include structural improvements as well. Certain structural measures are applicable to point and nonpoint sources and certainly within the spirit of pollution prevention. Examples of such measures include capping of soils contaminated with mine tailings, construction of urban runoff holding and treatment facilities, installation of drag-out pans at industries, and development of proper pesticide and herbicide storage facilities.

Our recommended approach to pollution prevention, outlined in the following section, expands the scope of pollution prevention to address these additional sources and structural measures.



HOLISTIC APPROACH TO POLLUTION PREVENTION

FIGURE 4

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Tri-TAC Water Committee

Section 3

Recommended Approach to Pollution Prevention

May 1994

SECTION 3

RECOMMENDED APPROACH TO POLLUTION PREVENTION

In August 1992, Tri-TAC developed an issue paper, entitled: "Watershed Management Approach to Toxicity Control." This paper recommended modifying EPA's existing water quality-based approach for achieving water quality standards by implementing a comprehensive watershed management approach to identifying, prioritizing, and controlling the sources of toxic pollutants. The recommended watershed management approach provides the framework for a clearly defined role for pollution prevention. This section discusses the role that pollution prevention should play in the overall watershed management approach to toxicity control, as well as Tri-TAC's recommendations for developing an efficient, broad-based pollution prevention program.

WATERSHED MANAGEMENT APPROACH

The watershed management concept is becoming established as the logical envelope for implementing water quality improvements in accordance with the natural physical divisions of aquatic ecosystems. This concept is already embraced in theory by the Clean Water Act (CWA) and the regulatory community. However, the Act does not currently include an integrated implementation program for watershed management other than identifying steps for reducing pollutants from point sources. New provisions for a somewhat expanded watershed management approach to toxics control are expected to be incorporated into the CWA as part of the ongoing reauthorization process. Hopefully these new provisions will adequately address the need to actively control nonpoint source loadings through pollution prevention.

Tri-TAC's recommended watershed management approach is rooted in the belief that further investment in point source controls will produce diminishing returns in water quality enhancement where a far greater contribution of toxics entering our nation's waterways are from non-point sources. In addition to recommending a prioritization process for targeting point and non-point sources for water quality control actions, the 1992 issue paper called for the implementation of minimum standards of operation (MSOs) for all significant point and non-point sources.

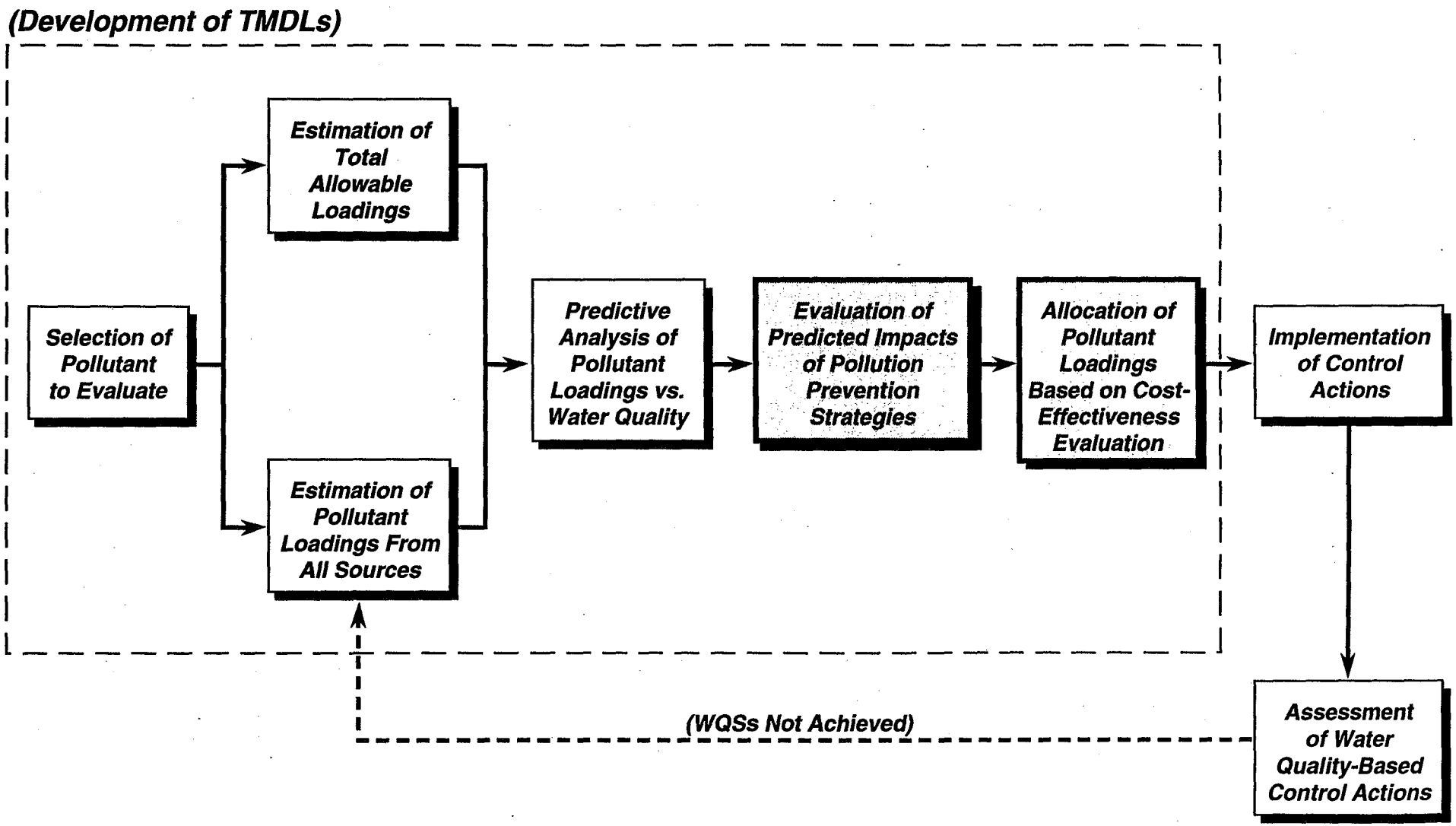
The watershed management approach is fundamentally tied to pollution prevention because it helps to define two notorious questions surrounding pollution prevention programs: "Who should be required to do pollution prevention?" and "To what extent should pollution prevention be carried out?"

Figure 5 shows how Tri-TAC's recommended watershed management approach (a modified version of EPA's existing Total Maximum Daily Loading (TMDL) process) utilizes the predicted impacts of pollution prevention strategies on pollutant sources to determine the appropriate allocations of pollutant loadings among the key sources contributing to a watershed. This approach calls for a review of available historical data and other pertinent information on pollution prevention options and the associated potential reductions for each key source. In light of the maximum pollutant loadings allowed to enter the watershed (TMDL), and the expected loadings reductions to be obtained from each source through pollution prevention, an appropriate pollutant loading is allocated to each source. This approach dictates that certain priority sources will be targeted for strict reductions, whereas other sources must merely comply with minimum standards of operation (MSOs) in order to meet their pollutant loading allocation. Selection of these priority sources is determined through watershed management.

If water quality standards (WQSs) are not achieved following subsequent implementation of control actions and monitoring, then the process could be repeated with more site-specific information and a better idea of the expected impacts of pollution prevention measures. However, Tri-TAC realizes that in some cases, low-cost pollution prevention measures alone may not be sufficient to attain water quality standards. In these cases, end-of-pipe treatment, or other more capital intensive structural measures, should be employed as necessary where the most significant reductions in pollutant loadings can be attained.

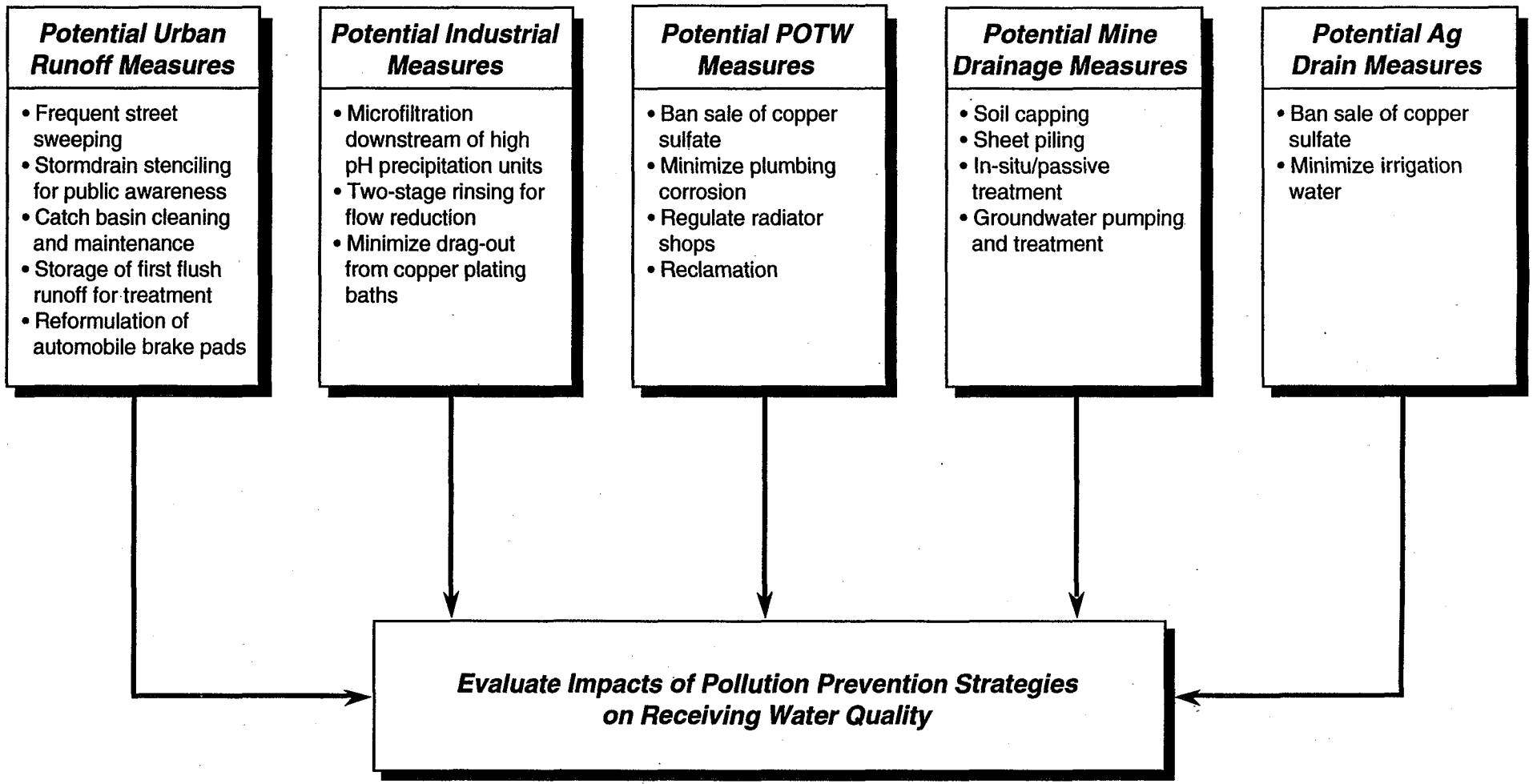
TARGETING POLLUTANT REDUCTIONS

A cost-efficient watershed management program relies on a clearly defined methodology for targeting which watershed sources should implement extensive pollutant reduction measures versus merely employ MSOs. Figures 6 and 7 use copper as an example to highlight the types of pollutant reduction measures that might be evaluated and how a ranking process must be incorporated into the watershed management approach to cost-effectively reduce toxic loadings into a watershed.



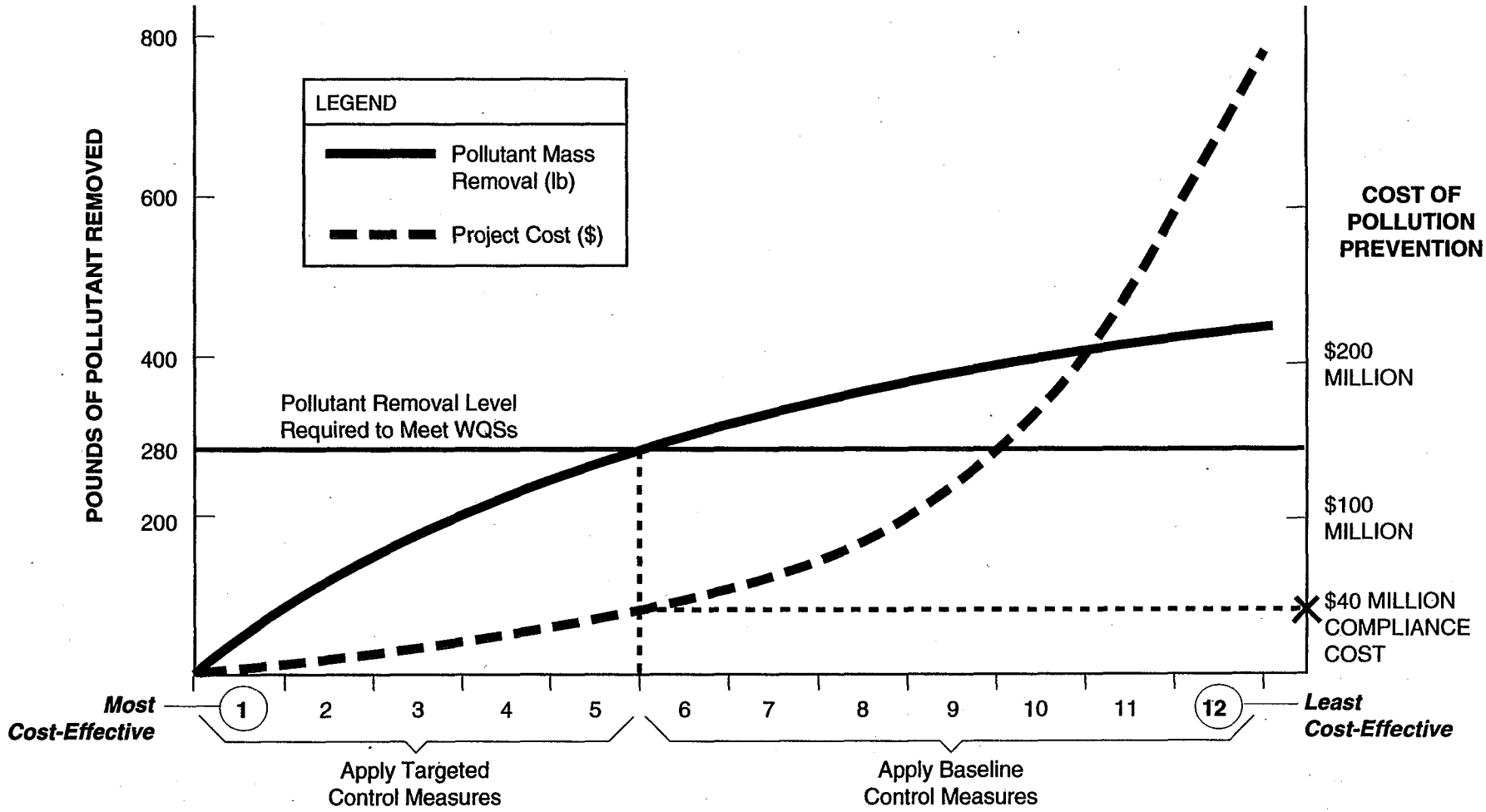
THE ROLE OF POLLUTION PREVENTION IN WATERSHED MANAGEMENT APPROACH

FIGURE 5



EXAMPLES OF POLLUTION PREVENTION MEASURES FOR COPPER REDUCTION

FIGURE 6



ALTERNATIVES RANKING FOR COST-EFFECTIVE IMPLEMENTATION

FIGURE 7

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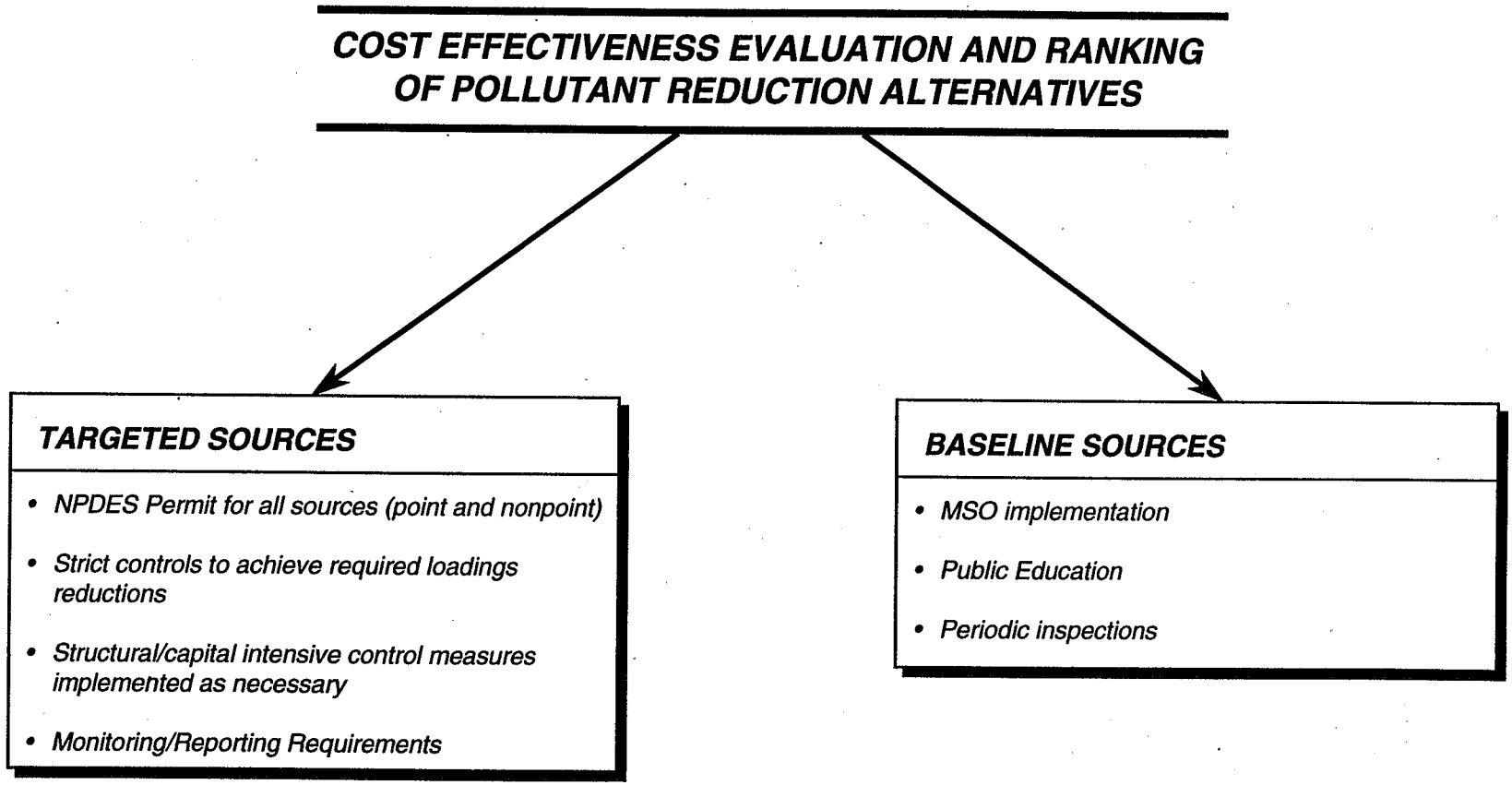
Feasible pollution prevention and end-of-pipe treatment measures would be developed at each of the sources listed in Figure 6, and then ranked for comparison purposes on the basis of expected dollars to be spent per pound of copper expected to be removed ($/lb). As seen from this figure, pollution prevention measures can take the form of educational/outreach measures (e.g., storm drain stenciling) or more structural solutions such as building stormwater catch basins or implementing wastewater recycling programs at POTWs. Although extensive information is not currently available on cost-effectiveness for ranking many of these control measures, Tri-TAC believes that by developing a consistent protocol (e.g., the watershed management approach) through which such information can be employed, the appropriate data will eventually be gathered through various programs to facilitate this ranking procedure.

The ranking of the watershed management pollutant reduction measures by expected cost effectiveness would allow selection of high-priority control measures, and a prediction of the expected implementation cost to reduce the overall watershed mass loadings to levels below the water quality standards. The cost-effectiveness of pollution prevention measures would be ranked side-by-side along with end-of-pipe treatment measures to determine which should be selected for implementation. In the example illustrated in Figure 7, the annual copper loadings to the watershed exceeded the WQSs by 280 lbs/yr. In order to meet these WQSs for copper, the five most cost effective reduction measures (pollution prevention and end-of-pipe treatment measures) would need to be implemented at a total cost of $40 million. By applying this approach to pollution prevention, there is a clearly defined purpose for each reduction measure. Each source targeted for extensive reduction measures would know why they are expected to perform the measures, and to what extent they must be carried out. The remaining sources would initiate MSOs such that no easily controllable copper loadings would be contributed to the water body.

A Two-Tiered System: Targeted and Baseline Programs

As seen in Figure 8, the cost-effectiveness evaluation would divide the pollutant sources into two groups: "Targeted" sources and "Baseline Sources." The Baseline sources would not be targeted for specific pollutant reductions, but would be required to operate using MSOs such as public education measures and/or a monitoring program. The expected pollutant loading reductions to be divided among the targeted sources would then be calculated as the difference between the reductions expected through implementation of the baseline MSOs and those reductions required to comply with water quality standards. MSOs are thus an integral part of the watershed



A TARGETED APPROACH TO COMPLIANCE WITH WATER QUALITY STANDARDS

FIGURE 8

management approach, which are supplemented by cost-effective reduction measures (pollution prevention and/or end-of-pipe treatment) targeted at certain pollutant sources.

Pollution Prevention for Targeted Sources. The targeted sources would have specific pollutant reduction goals tied to the WQSs for the watershed. Compliance with these reductions would be tightly regulated. For these sources, the most cost-effective pollution prevention strategies would be compared to end-of-pipe treatment measures over a specific horizon (e.g., 20 years) to determine the least costly and most environmentally sound alternative for each source. In general, these analyses will be done on a pollutant-by-pollutant basis, but consideration must be given to the secondary benefits of loadings reductions for other pollutants as well.

If advanced end-of-pipe treatment measures or other structural solutions prove to be the most cost-effective means for these sources to meet their target reductions, then these capital intensive measures should be implemented rather than conventional pollution prevention measures. It is expected that targeted sources may include point and/or nonpoint sources.

Baseline Program. Minimum standards of operation must be developed for all point and nonpoint sources of pollutants of concern that are not targeted for specific pollutant reductions to a watershed. Where water quality standards are currently being met for a given watershed, all sources would still be required to employ MSOs. This would serve as a non-degradation measure for watersheds currently in attainment with the CWA objectives. For POTWs required to employ this baseline program, a standardized baseline pollution prevention program would be developed that could include measures such as the following:

- Requirements for all industries to perform pollution prevention audits under the existing pretreatment programs to identify reasonable control measures.

- Dissemination of state and federal literature on best management practices to be employed at residences and commercial and industrial facilities; and

- A public education program consisting of a minimum number of cost-effective outreach measures

SUMMARY OF RECOMMENDED APPROACH TO POLLUTION PREVENTION

Tri-TAC's recommended approach to pollution prevention relies on incorporating pollution prevention measures into an overall watershed management approach to toxics control. The following points summarize the recommended approach for water bodies not currently attaining the water quality standards (WQSs) developed in accordance with the current Clean Water Act.

- Using the watershed management approach, the major contributors of specific toxic pollutants to a given water body are identified, regardless of whether or not they are point or nonpoint sources. These contributors may vary for different pollutants.

- The alternative pollution prevention measures and expected feasible pollutant reductions are identified for each of the pollutant contributors.

- A cost-effectiveness evaluation is conducted to allow a ranking of the alternative pollution prevention measures at each source according to the expected dollars spent per pound of pollutant removed. The cost-effectiveness of the most cost-effective pollution prevention measures is compared to that of end-of-pipe treatment measures at each source.

- Alternative pollutant reduction measures are selected among the different sources (in decreasing order of cost-effectiveness) depending on the total mass reductions required to achieve the WQSs for the associated water body. The most cost-effective pollutant reduction measures could include both pollution prevention measures at certain sources and end-of-pipe treatment at others.

- The most cost-effective "targeted" sources are assigned specific numerical loadings reduction goals that must be complied with. The remaining sources must employ a baseline program that includes minimum standards of operation (MSOs).

For water bodies that are currently in attainment with WQSs, all associated pollutant sources would be required to employ MSOs, but none would be targeted to achieve specific loadings reductions.

Tri-TAC Water Committee

Section 4

Recommended Actions

May 1994

D-037920

SECTION 4

RECOMMENDED ACTIONS

In order to fully implement the pollution prevention programs described above, a more focused approach must be developed to support these programs. Significant assistance is required from EPA and the California State Water Resources Control Board (State Board) to revise the current approaches towards pollution prevention and compliance requirements for POTWs. This section discusses recommended actions for these agencies to fully implement a coordinated, holistic approach to pollution prevention within the framework of watershed management. The following action measures are discussed below:

- Adopt a Statewide Policy and Approach to Pollution Prevention
- Recognize Pollution Prevention as a Means of Achieving Mass Reduction
- Develop Regulatory Incentives for Reclamation
- Resolve Conflicts Between Regulatory Measures
- Develop Minimum Standards of Operation (MSOs) for Pollution Prevention and Disseminate Available Literature
- Provide Technical Assistance with Commercial Pollution Prevention
- Provide Technical Direction and Guidance with Product Restrictions

ADOPT A STATEWIDE POLICY AND APPROACH TOWARDS POLLUTION PREVENTION

As a first step towards a coordinated, holistic approach to pollution prevention, the State Board should adopt the Tri-TAC approach to implementing pollution prevention within the framework of watershed management, as described in Section 3 of this issue paper. This approach should include baseline and targeted pollution prevention programs aimed at all point and nonpoint sources to achieve water quality standards in the most cost-effective manner. Structural and non-structural pollution prevention measures should be considered in the cost-effectiveness evaluation.

RECOGNIZE POLLUTION PREVENTION AS MEANS OF ACHIEVING MASS REDUCTION

While pollution prevention is an obviously effective means of controlling toxics, the current water quality regulations hinder its full implementation at some POTWs. For many POTWs who have to comply with stringent numerical effluent limits, pollution prevention is considered to be a more viable and desirable method of achieving compliance than advanced end-of-pipe treatment. Advanced treatment processes (such as reverse osmosis) are extremely costly, generate highly concentrated waste streams of toxic pollutants, and may not be able to reduce some pollutants in typical wastewater down to the associated water quality criteria (Palo Alto, 1992).

POTWs would prefer to utilize pollution prevention and the incidental removal of pollutants by the wastewater treatment processes as the means for compliance. In California, the effluent limits of the POTWs are based on the EPA national water quality criteria. Many of these criteria are expressed as standards that should not be exceeded more than once every three years, on the average. For those POTWs that monitor their effluent for compliance on a weekly basis, this translates to complying with the limits 99.4 percent (155 out of 156 samples over a 3-year period) of the time. For POTWs not given any mixing zone considerations, the limits can be extremely stringent. As an example, in south San Francisco Bay, three POTWs are required to comply with a copper effluent limit of 4.9 parts per billion (ppb).

Within the last four years, all three POTWs have expended significant efforts in pollution prevention programs. Unlike parameters such as biological oxygen demand and total suspended solids, POTWs cannot directly control the concentrations of toxics in their effluent. At one facility, the influent copper loadings decreased from an average of 135 pounds per day (ppd) to 93 ppd from 1991 to 1993. Over the same period, that facility exceeded its copper effluent limits consistently. While the three facilities will continue to implement pollution prevention measures for copper, it remains questionable whether reduction in influent loadings would ever translate to compliance with its effluent limits. The ability of a typical POTW to comply with its effluent limit for toxics is dependent upon three factors:

1. Reduction of pollutants from all contributing sources (water supply, industries, residences, and commercial establishments) as a result of pollution prevention.
2. Temporal and spatial fluctuations in the flows and concentrations of all these contributing discharges.

3. Incidental removal of toxics (the amount for certain toxics could be substantial) at the POTWs.

Analysis of historical data at POTWs indicate that as influent loadings decrease, the incidental removal rates of pollutants also tend to decrease, and a number of physical and chemical mechanisms affect toxics removal (Palo Alto, 1994). That is, influent reduction does not necessarily result in a linear reduction in the effluent. Appendix B contains data showing historical relationships between influent loadings and pollutant removals, and between influent and effluent concentrations at two facilities. General trends of these data indicate that pollutant removal rates tend to decrease with decreasing influent concentrations, and there is little direct correlation between influent and effluent concentrations.

If strict adherence to the water quality standards were required, POTWs probably would not be able to utilize pollution prevention to achieve compliance. POTWs would be required to resort to the end-of-pipe advanced treatment processes with their associated negative environmental and economic impacts. In the Pollution Prevention Policy Statement, EPA Administrator Carol Browner stated that "Where these statutes present significant barriers to reducing waste at the source, however, we should not hesitate to share this information with Congress and, if needed, seek appropriate statutory changes." Tri-TAC recommends that EPA extends its Pollution Prevention Policy to the POTWs responsible for controlling toxics from wastewater and stormwater discharges. EPA should recognize pollution prevention as the preferred means over advanced treatment systems. Advanced treatment at POTWs for the purposes of toxics control should only be required where the POTW has been determined to be a priority "targeted" source based on the recommended watershed management approach discussed in the previous section.

In order to promote full implementation of pollution prevention, it is recommended that EPA revise the Clean Water Act in order to achieve the following:

- Recognize that pollution prevention is an effective means of mass reduction.
- Recognize that there is uncertainty in applying pollution prevention to comply with maximum numerical limits.
- Shift towards mass limits as the regulatory mechanisms and promote pollution prevention as the means of compliance.
- Require strict compliance with effluent water quality criteria only at sources that have been targeted for pollutant reductions as part of the watershed management approach.

DEVELOP REGULATORY INCENTIVES FOR RECLAMATION

The current regulations also provide no incentives to implement a very effective pollution prevention measure: wastewater reclamation. In addition to the obvious water conservation advantages, reclamation would reduce the mass loadings of pollutants to a receiving water body. For some POTWs, where the economics of water conservation are marginal, effluent compliance could provide the necessary incentives to implement reclamation. However, since reclamation does nothing to reduce the effluent concentrations discharged from POTWs, unless 100 percent of the effluent were reclaimed, reclamation would have no effect on a POTW's ability to comply with the maximum, not-to-exceed effluent concentration limits. As long as these limits are in place, POTW have no incentives to promote reclamation for both water conservation and pollution reduction purposes. It is recommended that EPA, in conjunction with the regulatory review described earlier, modify the current regulations in order to create incentives to implement reclamation for pollution prevention. A shift away from concentration limits to mass limits, as discussed above, would provide some of the needed incentives for reclamation.

RESOLVE CONFLICTS BETWEEN REGULATORY MEASURES

EPA and the State Board should resolve conflicts between existing regulatory measures in order to promote implementation of pollution prevention. An obvious conflict is between the Clean Water Act and the Safe Drinking Water Act over the issue of plumbing corrosion. In several pollution source identification studies conducted in Northern California (Palo Alto, 1994; San Francisco, 1993; San Jose/Santa Clara, 1993; Sunnyvale, 1993), corrosion in the plumbing was estimated to contributed 31 to 46 percent of the influent copper to the respective facilities. Since three of the four POTWs consistently violated their copper effluent limit, reduction of copper from plumbing corrosion would appear to be a viable source. While the water supply agencies are generally very cooperative, the current water quality standards have produced some conflicts between actions required to comply with the Safe Drinking Water Act and the Clean Water Act. The copper action level in the Safe Drinking Water Act is 1.3 parts per million (ppm) while the water quality objective and effluent limits for Palo Alto, San Jose/Santa Clara, and Sunnyvale are 4.9 parts per billion (ppb). The estimated composite copper concentration in the water supply in these agencies is generally in the range of 35 to 50 ppb. Currently, several water supply agencies are evaluating corrosion control options in order to comply with the Lead and Copper Rule. While most water supply agencies are sensitive to the concerns of the POTWs, there is no driving force for them to reduce copper much beyond the current levels. At the same time, the

POTWs have no avenue to require greater reduction in the plumbing corrosion, even though that has been identified as a major source of copper.

Another area where regulatory conflicts arise is that of cross-media concerns. Pollution prevention goals must be developed with a coordinated approach towards the individual goals of municipal and hazardous solid waste, air, and water agencies. For example, as the POTWs become more sophisticated in pollution prevention, they are discovering that they must also take on the role of hazardous waste facilities inspector and/or a transfer station for household toxics. Additional guidance or assistance in this area would reduce the additional regulatory and staffing burden that this places on pollution prevention personnel.

DEVELOP MINIMUM STANDARDS OF OPERATION FOR POLLUTION PREVENTION AND DISSEMINATE AVAILABLE LITERATURE

As described in Section 3, Tri-TAC's proposed baseline program for pollution prevention calls for minimum standards of operation (MSOs) to be employed at all point and nonpoint sources of pollutants of concern that are not targeted for specific pollutant reductions to a watershed. EPA and the State Board should take the lead in defining MSOs for different sources (e.g., POTWs, agricultural sources, stormwater sources), developing guidance where necessary, and disseminating available state and federal literature on best management practices to be employed at residences, commercial, and industrial facilities.

An accessible, efficient, literature and data clearinghouse would be an effective means of assisting smaller municipalities in implementing current pollution prevention measures as new techniques are developed. This service must not limit its resources to published articles or documents. Rather, it should include copies of pamphlets, brochures, cost-effectiveness data, or any other materials (catalogued by source category or pollutant) that could provide a service to interested persons seeking assistance with pollution prevention. As more data collected on the effectiveness of certain pollution prevention measures, decisions based on cost-effectiveness of certain measures will become increasingly well-informed. A publicly accessible technology transfer and management system is needed to disseminate such information.

TECHNICAL ASSISTANCE WITH COMMERCIAL POLLUTION PREVENTION

To try to define the sources of pollutants, POTWs have typically tried to perform mass balances comparing the influent loadings with the known sources. Figure 2 presented the relative percentages of copper contributed by various sources at one wastewater treatment plant discharging to southern San Francisco Bay. These percentages are fairly typical of POTWs in the Bay area. As shown on the figure, industrial and identified commercial (automotive service, machines shops, printers, etc.) contributions only accounted for about 20 and 5 percent of the influent loadings, respectively. Loadings from the "other" category, calculated as the difference between the influent and the known sources, accounted for 24 to 32 percent of the influent. This "other" category is believed to comprise of a large number of small commercial facilities discharging low, intermittent flows at low to medium strength.

EPA has traditionally focused its attention on the large industrial facilities. A number of manuals have been developed dealings with waste streams from industries such as metal finishing and electroplating. Many of these documents are also geared toward the reduction of hazardous waste or the treatment of waste to non-hazardous levels. Within California, most of these "categorical" industries have been regulated for a number of years and their control technologies are well understood. Recently, many California POTWs are expanding significant efforts to identify additional sources of pollutants and to evaluate viable pollution control measures. Some of the commercial categories that have been increasingly regulated in California include radiator repair, automotive service facilities, photo processing, and dry cleaners. However, beyond these facilities, POTWs have not been able to identify other significant commercial sources of concentrated waste streams. The cumulative loadings from these sources are believed to be contributed by specific processes or activities (e.g., corrosion, algae control, cleaning products) that produce waste streams of low concentrations. It appears that a system-wide evaluation aimed at controlling specific activities would be an appropriate next step.

It is recommended that EPA assumes the lead role in characterizing waste streams from the commercial and residential sectors. In addition to identifying these waste streams, feasible pollution prevention measures should be evaluated and established for any controllable products, sources, or waste streams of potential concern. These measures could be applied broadly to commercial sources as part of a baseline MSO program. The pollution prevention measures should focus on compliance with typical water quality standards rather than compliance with hazardous waste regulations.

TECHNICAL DIRECTION AND GUIDANCE FOR PRODUCT RESTRICTIONS

Many POTWs have found a public education program to be an effective residential pollution prevention measure. By raising the awareness of the general public, pollution prevention in both wastewater and stormwater can be achieved. Generally, consumer products have not been identified as major contributors of toxic pollutants (San Francisco, 1991). However, in some instances, where products are identified as significant pollutant contributors, restricting specific products can be a viable means of preventing significant pollutant loadings from entering into the sewer or storm drain systems. In addition to impacting pollutant loadings from residences, in many cases higher-strength products (e.g., cleaners, disinfectants, algaecides) are used at commercial and industrial facilities. Restrictions imposed on certain uses such as these could also be an effective pollution prevention measure.

Product restrictions, where appropriate, are more effective when imposed on a regional or state-wide level than on an agency-by agency level. One northern California POTW recently banned the use of copper sulfate root killer in its service area. It has implemented a public education program and has convinced all hardware and plumbing supply stores within its service area to stop selling this product. However, these pollution prevention measures are not believed to have completely eliminated the discharge of copper sulfate root killer as individuals can still easily purchase the product from stores in adjacent areas. If the ban were implemented on a regional level, its effectiveness would increase accordingly. Other products that may fall into a similar category include pesticides, copper brake pads and other vehicle-related products. It is recommended that EPA assumes the lead in identifying consumer and commercial products that contain notable amounts of toxic pollutants and in encouraging substitute materials. It is also recommended that the State Board develop guidance and leadership in banning the uses of products (identified by EPA) on a regional or state-wide level.

SUMMARY OF RECOMMENDED ACTIONS

Tri-TAC is recommending that the following actions are taken by EPA and the State Board to promote full implementation of pollution prevention within the framework of watershed management as discussed in Section 3 of this issue paper:

- Adopt a statewide policy and approach towards pollution prevention.

- Develop a pollution prevention clearinghouse to disseminate educational materials and effectiveness data as they are developed.

- Shift towards mass pollutant limitations as the regulatory mechanism and promote pollution prevention as the means of compliance.

- Recognize that pollution prevention is an effective means of mass reduction.

- Recognize that there is uncertainty in applying pollution prevention to comply with maximum numerical concentration limits.

- Require strict compliance with effluent water quality criteria only at sources that have been targeted for pollutant reductions as part of the watershed management approach.

- Modify the current regulations in order to create incentives to implement reclamation for pollution prevention.

- Resolve conflicts between existing regulatory measures in order to promote implementation of pollution prevention.

- Develop pollution prevention goals with a coordinated approach towards the individual goals of municipal and hazardous solid waste, air, and water agencies; and provide additional guidance or assistance in this area to reduce the additional regulatory and staffing burden that this places on pollution prevention personnel.

- Take the lead in defining MSOs for different sources (e.g., POTWs, agricultural sources, stormwater sources), developing guidance where necessary, and disseminating available state and federal literature on best management practices to be employed at residences, commercial, and industrial facilities.

- Assume the lead role in characterizing waste streams from the commercial and residential sectors. In addition to identifying these waste streams, feasible pollution prevention measures should be evaluated and established for any controllable products, sources, or waste streams of potential concern.

- Assume the lead role in identifying consumer and commercial products that contain notable amounts of toxic pollutants and in encouraging substitute materials.

- Develop guidance and leadership in restricting the uses of products on a regional or state-wide level.

The Role of Pollution Prevention in Toxicity Control

Tri-TAC Water Committee

Appendices

May 1994

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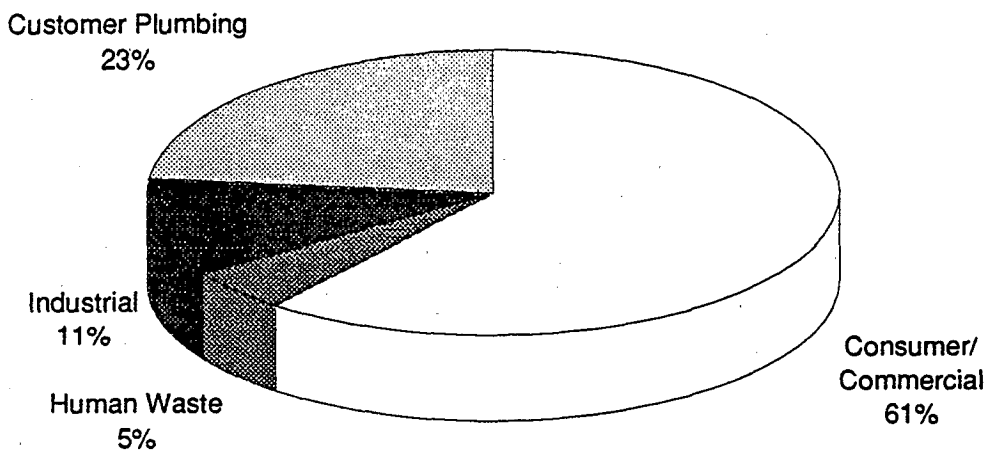
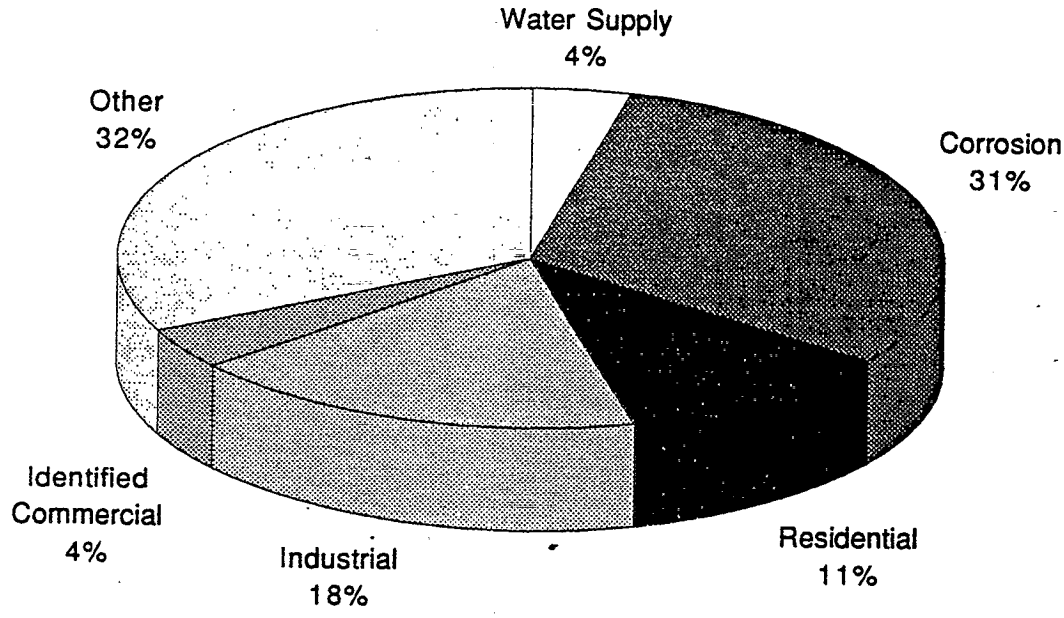
APPENDIX A

SOURCES OF POTW INFLUENT COPPER LOADINGS



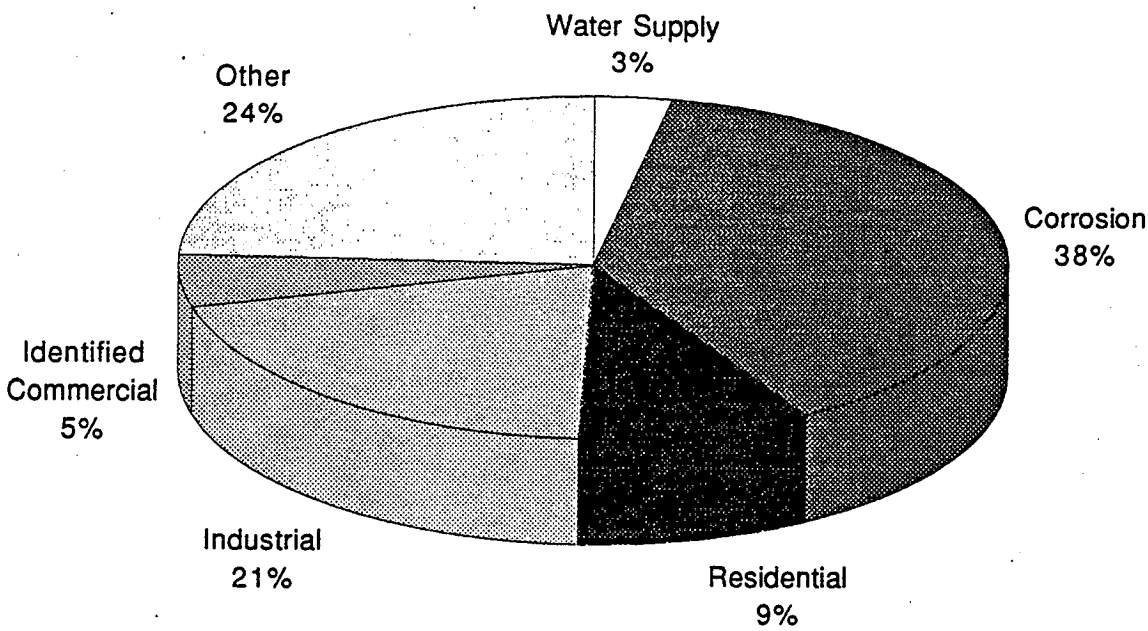
ESTIMATED DISTRIBUTION OF COPPER SOURCES TO EAST BAY MUNICIPAL UTILITIES DISTRICT

FIGURE A-1



ESTIMATED DISTRIBUTION OF COPPER SOURCES TO PALO ALTO REGIONAL WATER QUALITY CONTROL PLANT

FIGURE A-2

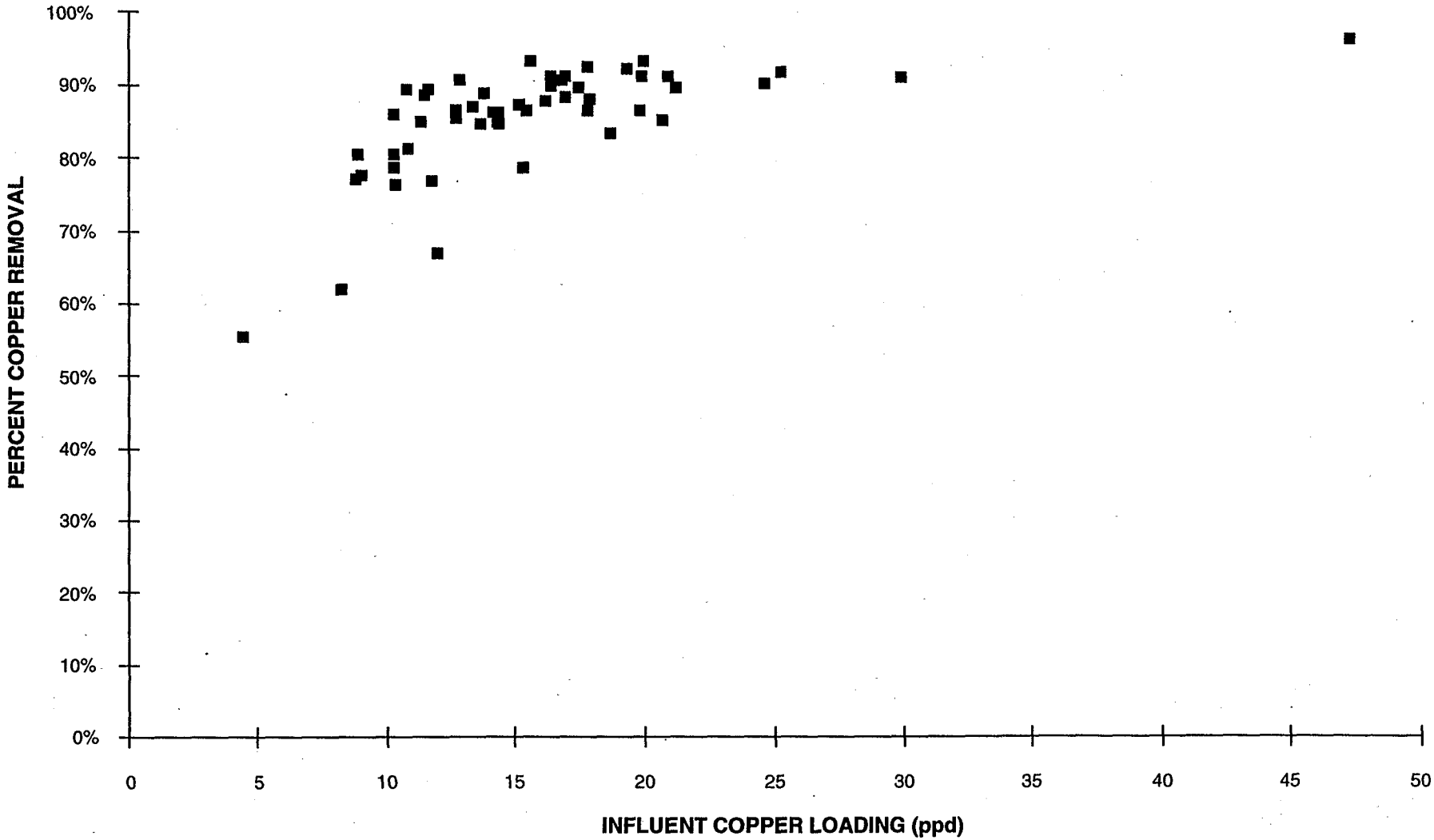


ESTIMATED DISTRIBUTION OF COPPER SOURCES TO SAN JOSE / SANTA CLARA WATER POLLUTION CONTROL PLANT

FIGURE A-3

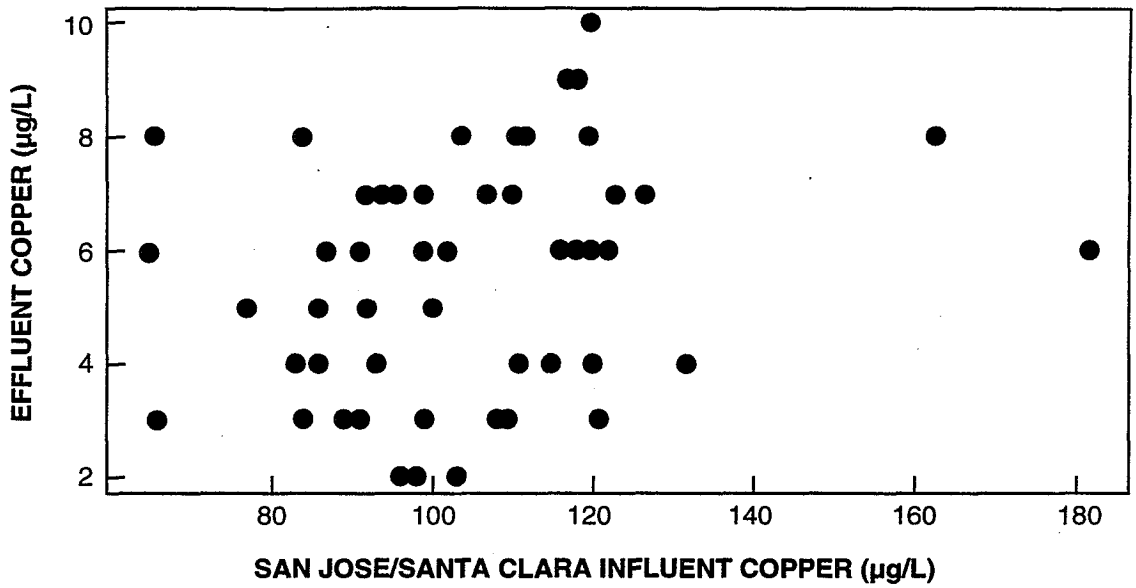
APPENDIX B

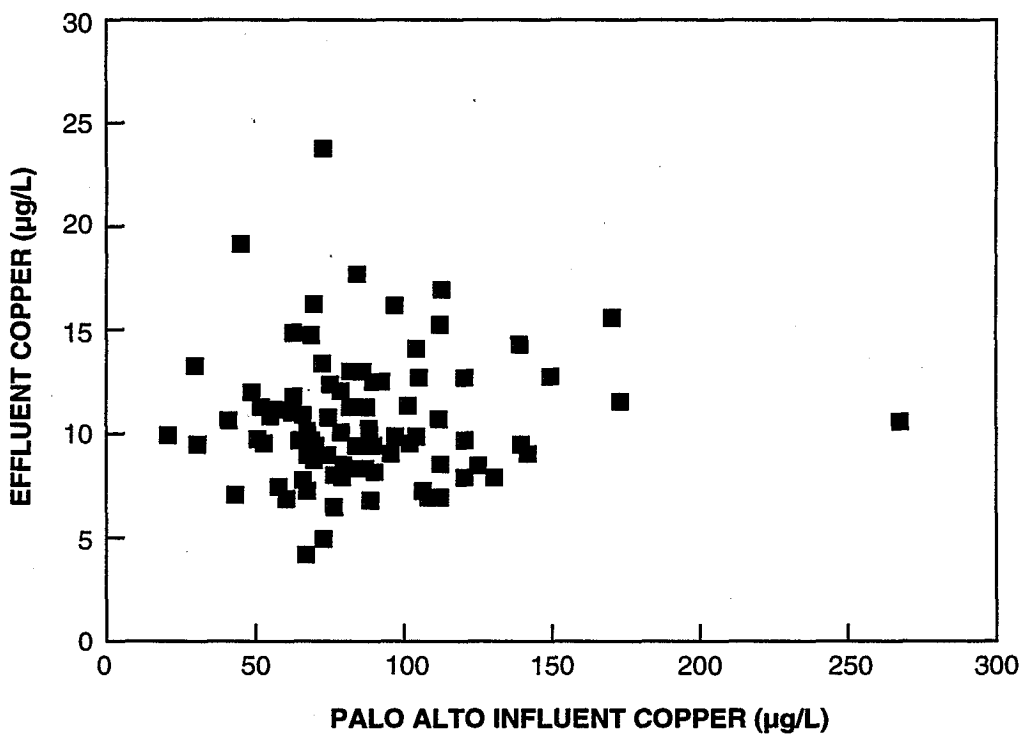
RELATIONSHIPS BETWEEN POTW INFLUENT AND EFFLUENT LOADINGS



RELATIONSHIP BETWEEN INFLUENT COPPER LOADING AND PERCENT REMOVAL AT PALO ALTO

FIGURE B-1





CORRELATION BETWEEN INFLUENT AND EFFLUENT COPPER CONCENTRATION AT SAN JOSE/SANTA CLARA AND PALO ALTO POTWs

FIGURE B-2

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APPENDIX C

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REFERENCES

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